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Lessons from the Docks

A VISIT to the great docks of London affords a close-up impression of trade revival at the present time, and to the engineer interested in the bulk-handling of materials it forms a refreshing experience. Nowhere can he find a better opportunity for instructive observation of such operations as in dockland, and if he is able to combine with such an experience a study of the important part that electricity plays in connection with the vast undertaking, a feeling of pride has a large place amongst his other emotions. He finds about him warehousing accommodation and facilities for over a million tons of merchandise, and two docks alone where goods to the colossal value of something over 700 million pounds sterling per annum are handled.

Seldom have we seen so many major industrial electrical uses under the control of one organisation, and, as will be gathered from the article appearing on pages 208-5 of this issue, at every turn there is a profitable lesson for all who have electrical advancement at heart.

For the country's water-supply schemes much useful information should be available as the result of the experience of the docks' engineers in catering so successfully for the dewatering and impounding requirements. Is it possible to see so many varied methods of pump control elsewhere? Certainly such controls could not be adapted so conveniently to any form of non-electric drive.

The easy operation of the bascule and rolling lift bridges largely by virtue of the trip-switch brings home to us the importance of this useful and simple device; and so with the float-operated and limit switches. Any idea that things electrical necessarily mean complication should be dispelled by a mental picture of the Donald self-contained banana unloading conveyor. It might well be asked, "Why hasn't it been done before?" The main point is, however, that the equipment is essentially electrical.

The excellent battery-charging stations for the quay and warehouse trucks arouse thoughts of the enormous amount of man-handling of materials, in and about works, awaiting supersession by battery trucks. Besides efficient charging plant and low night tariffs, all that is wanted is adequate business surveying.

In saying that where the electrical industry enjoys advantages from applications of its own craft to any other industry it has some responsibility for the advancement of its neighbours, we have in mind particularly the extensive and exceptional cold-storage facilities at the docks. With to-day's favourably changing outlook on food preservation, where could not cold-storage be introduced with advantage?

Not the least notable feature of this huge electrical installation is the lighting system, which was designed to permit the normal activities of the day to be carried on throughout the night, with saving in time and "tides" and considerable lessening of the dangers of navigation in confined areas. In a description of this lighting published in the ELECTRICAL REVIEW at the time of initiation of the scheme it was shown how the distribution-peak intensity at 65 deg. to the vertical and the safety-promoting cut-off of about the same angle are given an almost precision accuracy. From the utility, commercial and technical viewpoints conjointly, could the results be improved on to-day, with the more recent discharge-lighting equipment available?

At the moment, when impressions of new works at the docks are very clear in our mind, the Port of London Authority announces a new £12,000,000 improvement scheme. Just as the docks engineers deserve high credit, so does the electrical industry deserve a good share of this new expenditure on England's largest system of docks.

N.E.C.T.A. and Radio Retailers

SOME time ago N.E.C.T.A. (the National Electrical Contractors' Trading Association) took steps to form a National Association of Radio Retailers. It pursued this course at the request of a very large number of radio retailers. We learn from Mr. L. C. Penwill, the Director and Secretary, that arrangements are well in hand and an invitation to radio retailers to become members will shortly be issued. Preliminary statements appeared in the Press giving the name of the new body and indicating that it would operate under the auspices of N.E.C.T.A. The fuller particulars, when available, will be welcomed by both the electrical contracting and the radio trades. We ought to add that we have had our attention called to an announcement published in the Press during the past week regarding the formation of a second association with precisely the same name. Mr. Penwill asks us to inform our readers that this project is not in any way connected with the N.E.C.T.A. organisation. The latter body, as the electrical trade is well aware, has had lengthy experience of trade problems affecting the business of electrical contractors and retailers, and the record to its credit suggests that it is particularly well qualified to operate in the new direction indicated.

The Work of Testing Stations

THE short-circuit testing plants installed by British switchgear manufacturers are doing much more than demonstrate that circuit-breakers are up to their rated rupturing capacities. They are providing information of a fundamental character as to what takes place when a circuit is opened and closed, among other things. These investigations are likely to influence practice in the future, as solutions to switching problems are as yet largely empirical in character and many questions can be answered fully only as a result of further research. It does appear to the ordinary electrical engineer, however, that international agreement is unduly delayed regarding matters of such immediate practical importance as that of the method of calculating short-circuit current. Dr. C. C Garrard this week argues the case for using the total current and not its a.c. component. It would be interesting to hear views on the other side.

Oil-less Circuit-breakers

DESPITE the rapidly increasing knowledge of the conditions under which circuit-breakers are required to operate, failures occasionally occur for which no adequate explanations are forthcoming, as in the example cited in our Correspondence columns. Rare as such instances may be, it is essential to protect switchmen from any risk of injury, and remote operation should therefore be employed for breakers of large capacity. It is incorrect to assume, however, as "Duty-Cycle" seems to do, that British manufacturers have paid insufficient attention to the possibilities of oil-less circuit-breakers. Our information is to the contrary. It is now over two years since the first British installation was put into service by the North-Met. Co. Although embodying certain improvements over existing Continental types, these expansion breakers offered no apparent advantages over the oil-filled type that is standard both in this country and in the United States.

Organised Industry

IT is fairly generally recognised that the increased efficiency of our electrical industry to-day is largely the result of better understanding between manufacturers and efforts to reduce reckless competition in the sale of products of similar classes. The co-operative measures form one of the chief chapters in the story of the rise and development of the industry following upon years of ruthless and profitless policy which brought little good to anybody. The growth of collaboration in matters of common policy placed operations upon a more profitable and stable basis and efficiency of production followed the increased ability of sections of the industry to devote substantial sums to research and other such purposes. As this improved position was accompanied by a substantial increase of turnover the situation became better still and to-day the British electrical industry is in a very prosperous condition with every prospect of becoming more so if the world demand for electrification is allowed to continue. Trading policies for special groups have proved both their justification and their worth when conducted with reason and moderation; when they extend their activities to affect the interests of other groups they find their greatest difficulties. Such difficulties may be lessened when all parties are concerned with the success of the entire industry. The contribution on page 217 relating to "Price Rings" mentions a number of familiar considerations, and while the subject is a many-sided one the fact remains that a prosperous industry is better able to satisfy the consumer or the user than an industry such as we knew a decade or two ago.

Engineering Employment

THE growing activity of the various branches of the engineering industry in this country is satisfactorily reflected in the membership figures of the Amalgamated Engineering Union. Since the commencement of the present year the number of members has advanced from 228,359 to 253,365, which was the total at the end of last month. It is officially stated that 4,495 members were enrolled in July, and additions continue at the rate of 1,250 per week. There are, however, still 8,947 on the A.E.U. unemployment roll—3.76 per cent. of the membership, against 6.06 at the beginning of the year.

Electrical Conditions in Germany

ALTHOUGH conditions in the German electrical industry improved very considerably during last year they were still much inferior to those prevailing in 1932 when depression made itself felt very seriously. The improvement in the electrical export trade in 1935 mentioned in his report by Mr. E. C. D. Rawlings, Commercial Counsellor to the British Embassy, Berlin, was only made possible by price-cutting, as is clear from the fact that while the volume of plant exports rose from 11,500 tons in 1934 to 14,000 tons in 1935 the value actually fell from 30.2 million marks to 29.6 millions. The same tendency is shown in the case of lamps. On the other hand, Germany has had to pay proportionately more for her electrical imports, for while the quantity was halved in 1935, the value decreased by about 42 per cent. There was a substantial advance in electricity output; the increase amounted to 15.5 per cent. as compared with Great Britain's figure of 13.6 per cent. for 1935. The bad times which the electrical industry has passed through during recent years are reflected in the proposal of the Allgemeine Elektricitäts Gesellschaft to reduce its capital by about two-thirds and then replace it with new capital.

Indication or Illumination?

SIGNALLING by light has long since been classified separately from ordinary illumination work; indeed, the production of signalling equipment is a highly specialised branch of the electrical manufacturing industry. There is, however, another class of signalling work which is growing fast, in which, although the equipment is not actuated beyond normal switching "on" and "off," it is not used for illuminating surrounding objects or space. The class of "indication" equipment in mind embraces airport beacons, boundary and obstruction lights and wind tees such as we have seen recently at Gatwick, but we are thinking, also, of the purely indication lighting equipment used in connection with navigation on sea and river and in the docks, and also to an increasing, but smaller, extent in and about the factory. With the continued growth of this "indication by light" apparatus, we suggest that classifying it too closely with normal lighting equipment might lead to confusion and, perhaps, loss of business.

ELECTRICITY IN LONDON DOCKS

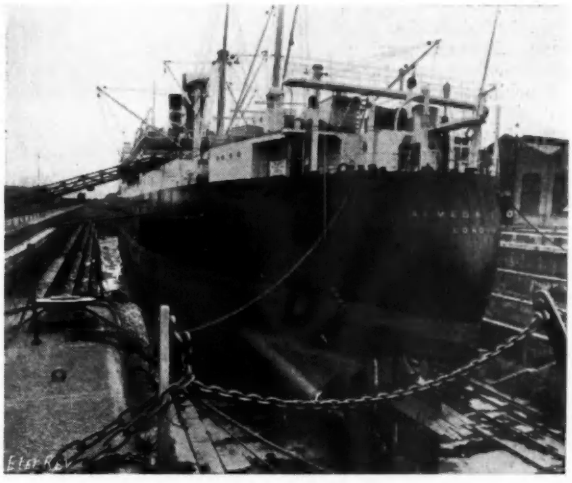
Widely varied electrical applications in some of the groups of the Port of London Authority

BY the courtesy of the Port of London Authority, we recently toured the Tilbury, Royal and India groups of docks where we saw how electricity is applied to the operation of lift bridges; to the transport, lifting and haulage of general materials; to the handling of grain and bananas by specially designed systems; to the provision of cold-storage facilities; to raising water levels in wet docks and dewatering dry docks; to the generation of hydraulic power for operating all manner of dockland equipment; and to the provision of compressed air for riveting, caulking, chipping and drilling during repairs to ships in dry dock. In all these particularly widely varied applications of electricity there are equally widely varied methods of both electrical and mechanical control of the electrical equipment.

At the new western entrance to the Tilbury Dock there is a rolling-lift bridge, that is, one in which the bridge leaves are moved horizontally away from the centre during their ascent. Actually, curved rails at the heel of each leaf ride on fixed rails as the leaves are lifted. The two leaves, jaw and diaphragm, are each driven by two 35-h.p. motors. Whilst normally only one of each pair of motors is used, the two motor rotors are mechanically coupled together through their shafts. The drive for each leaf is at the heel, and power is transmitted through a pinion at each side which travels along a fixed rack. At the dock end of each rack are three limit switches which the leaf engages and operates in sequence during the early part of its upward movement and the latter part of its downward movement. There is also a fourth limit switch at the far end of each rack which, of course, is operated at the end of the ascent and the beginning of the descent.

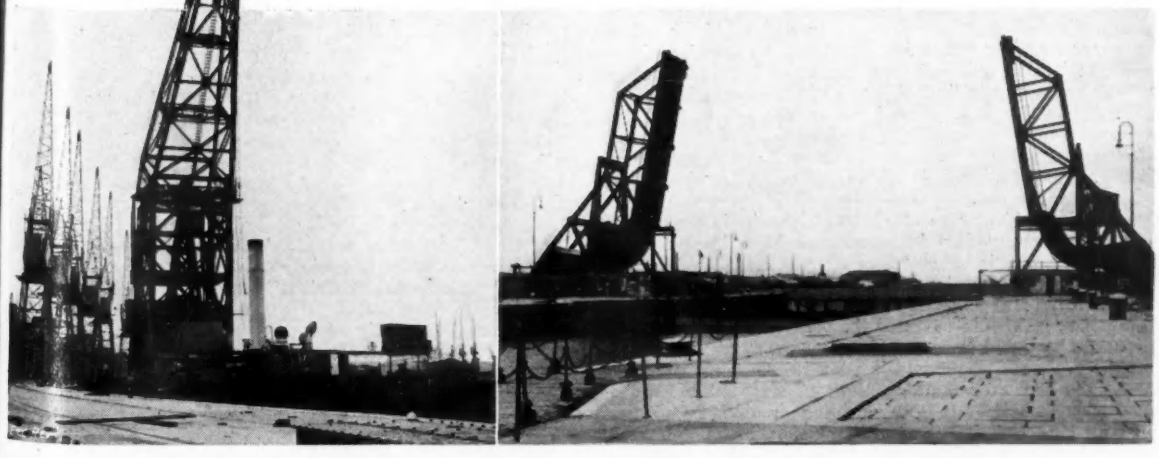
In the control tower with the switchgear and relay equipment is a drum controller by which the step-by-step operations of the bridge can be carried out by hand, or, with the handle thrown right over, the leaves may be left to operate automatically under the control of the limit switches referred to. In each case the major step-by-step operations are essentially the same. The jaw and diaphragm leaf motor brakes are first lifted, and the motors are then started up and run slowly with a diverter resistance across each armature. The armature resistance is cut out, the motors thereby being brought up to full speed, and when the nearly open position is reached the motors are slowed down until they are finally stopped and the brakes applied.

During the bridge-closing operation the driving is similar but with the sequence reversed, except that when the interlocking position is reached both brakes are applied and then lifted, after which both leaves are driven by the diaphragm leaf motors only through the interlock. Minor operations include inserting and withdrawing the bridge bolts and a good deal of signalling to and from the control tower.



The King George V dry dock

At the entrance to King George dock in the Royal Docks group we saw how the modern drive is applied to another type of bridge—bascule, in which the leaves turn about fulcrums. Each leaf is driven by two motors coupled together through clutches and located under the heel. The motors drive both ways to the east and west sides of the bridge *via* a comparatively small shaft, and then at each side through gearing



Left: The "London Mammoth" at the Royal Docks. Right: The rolling-lift bridge at Tilbury

to the main leaf drive. This is simply a pinion engaging with a curved rack on the under-side of the heel. All this driving equipment, of course, is situated behind or at the shore side of the fulcrum.

At the commencement of the opening operation a trip switch on the leaf completes the field regulation circuit, and simultaneously with the movement of the leaf an arm is carried up a vertical worm shaft gear operated from the main drive. At about a third of the distance up the worm a trip switch is actuated and this runs the motor up to full speed. When the arm is near the top of the worm another trip switch reduces the motor to creeping speed, and finally the motor is stopped at the top by another trip switch. On the descent the sequence of operations is reversed and in each case the motor starting is effected from the control tower, where there are three tramway-type controllers. One of these serves the six locking bolt motors and the other two are coupled together by chain drive and serve the two pairs of motors for driving the leaves.

At several different points in the India Docks group separate supplies are received direct from the Poplar undertaking—some at 6,600 V a.c. and some at 460 V d.c. Serving the granary at Millwall Dock there is a rotary convertor station equipped with two 300-kW G.E.C. convertors, each complete with a pony motor for starting. On a dolphin (island structure) there are complete suction discharging plants, each with two "Phœnix" 200-h.p. d.c. motors driving through gearing Reavell turbo-exhausters at 3,900 r.p.m. Brookhirst cabinets with hand ratchet control provide for the speed regulation of these motors. Via flexible suction pipes dropped into the hold of the ship the grain is drawn up into a canister from which it is either conveyed to the granary through a tipping room and scales and distributed for storage by an electrically driven conveyor and elevator system, or delivered direct to barges by gravity. We saw grain being delivered to barges from the base of the granary by short inclined elevator-conveyors.

Another special feature of the India Docks equipment is the banana-handling plant at West India Dock. For this work are employed "Donald" elevators—self-contained, electrically driven portable conveyor systems built up within angle-iron frameworks. Each structure is usually lifted by the ship's derrick and trussed up on the deck horizontally, so that one end is over the ship's hold and the other end over the quay. From each end of the frame "free" portions of the endless conveyor are lowered, in one case into the hold and in the other case to the quay. At about 3-ft. centres the endless conveyor is fitted with pieces of canvas which sag and form pockets at either end. At the various deck levels bunches of bananas (about 100 bananas to a bunch) are placed in the pockets of the rising conveyor to be carried up to the frame, along it and down to the quay for delivery at the other end.

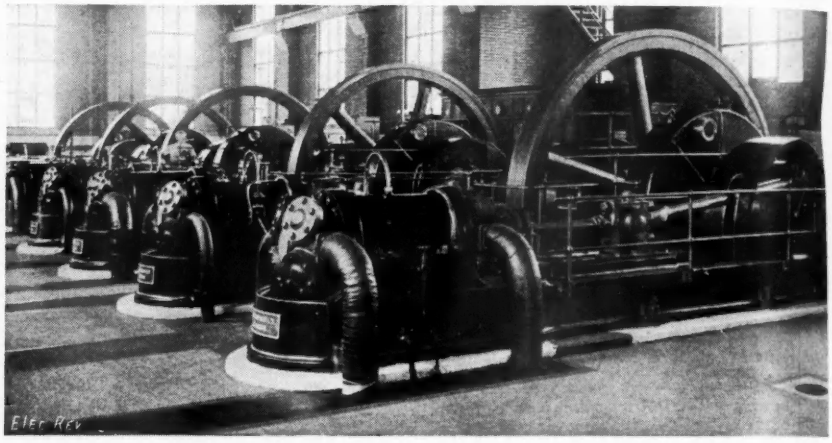
The driving motor for each conveyor is 3 h.p. and is operated by a drum-type controller located on a quay conveyor which works in conjunction with the Donald equipment. A trailing cable plug and socket feed is provided between the ship and quay equipments. At the time of our visit a 16-hour unloading programme for 100,000 bananas from the *Jamaica Pioneer* was completed, employing four Donald equipments. But the rate of unloading is limited by the rate of clearing at the quay and in the shed, which is about 650 ft. long, with four cross-conveyor feeds equipped with sectional drives, usually of about 2 h.p. for 30-ft. sections. On each cross conveyor is a B.T.H. light-sensitive cell equipment for counting the bunches of bananas handled.

Extensive cold storage at the Royal Docks is served by a large refrigerating-plant house at the Albert Dock equipped with five ammonia compressors driven by W. H. Allen 220-h.p. d.c. motors. An unusual spectacle associated with the electric drive is the 7-ton flywheels on these compressors. The compressed ammonia gas (150 lb. per sq. in.) is cooled and converted to liquid in externally water-cooled tube condensers on the roof, and the liquid is passed to various cold rooms about the docks for the absorption of heat, either by direct expansion in battery coils or *via* brine circulation equipment. We imagine that the half-mile transmission of compressed ammonia to one of the cold stores is something of a record.

Provision for charging the batteries of the numerous electric trucks used for transport on the quays and in the sheds is represented by some of the finest charging stations we have seen. In one at Victoria Dock two Newton d.c. to a.c. motor-generators serve a 30-panel charging board at 60 V. The panels are arranged side by side in one long row, with the two additional machine panels at the centre, and each charging panel accommodates a d.p. magnetic blow-out switch, a rheostat with a face-plate stud regulator and the usual instruments. In the garage nearby there are c.t.s. ceiling "drops" for plug and socket charging connection to the trucks at night. A charging system which we saw at the India Docks group embraces a similar board except that the panels are arranged in tier formation, while in the adjacent garage the charging leads feed from fixed points on a wall.

The enormous number of cranes on the quays include both direct electric and hydraulic equipments and generally they are of the level luffing portal type.

Of outstanding interest is the "London Mammoth," a floating-type crane of gigantic proportions and possessed of immense capabilities. When fully luffed, the jib reaches a height above the water-line greater than that of the high level of the Tower Bridge. The crane is capable of lifting 150 tons at an outreach of 98 ft. to a height of 130 ft. above water-line; 150 tons is lifted at 5 ft. per minute and 10 tons at 30 ft. per minute, while a full range of derricking can be performed in twelve minutes and a complete revolution in half that time.



Ammonia compressors in the cold-storage machine house, Royal Docks

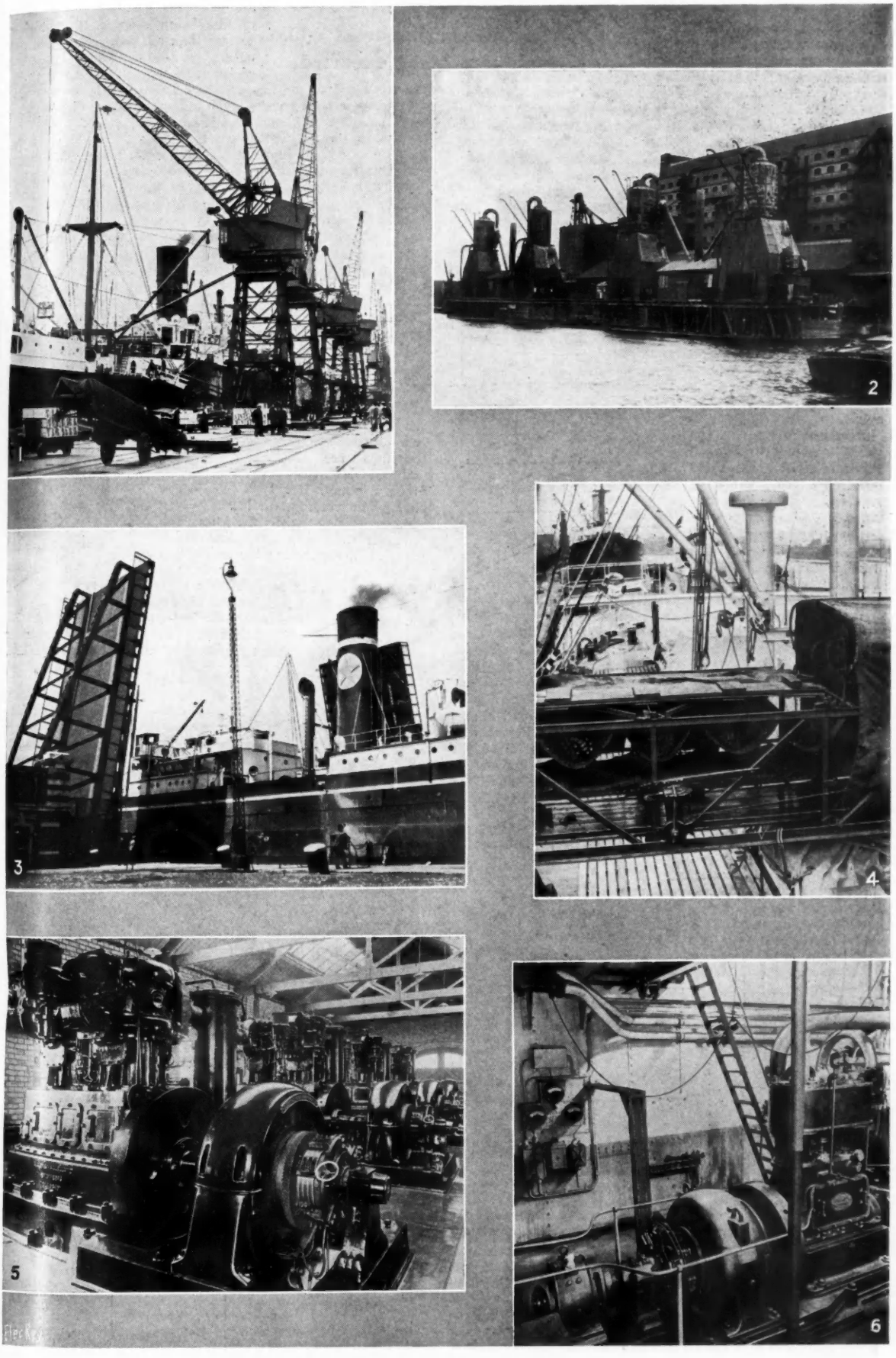
Built on the tower principle, the vessel is electrically driven. The engine-room in her hull is equipped with a boiler for raising steam for the twin-screw propelling engines which enable her to move about the river and docks, the deck machinery and the winches, and a 90-kW, 440-V generator for the hoisting, derricking and slewing motions which are controlled with precision. The motors installed are: Main hoist, 100 h.p.; derricking, 100 h.p.; auxiliary lifting, 60 h.p.; trolley lifting, 30 h.p. and 30 h.p.; and slewing, 50 h.p.

The pontoon is 200 ft. long, 75 ft. beam and 14 ft. deep, and of 1,580 tons. Built to Lloyd's Class "A" requirements for harbour purposes, the vessel is provided with two navigating bridges, ample accommodation for the crew, and is lighted by electricity throughout. A large area of the deck is specially strengthened and adapted for receiving heavy loads, so that they may be transported on the vessel between different parts of the Port.

A lengthwise extension of the quay at the north side of the Royal Albert Dock has resulted in the installation of ten new cranes fed by twin cable with tee-offs to plug-boxes, while where the position of the crane track has been altered in consequence of a quay-widening scheme the original distribution system with bare wires underground is being utilised. "Niphan" watertight plug and socket connectors are employed.

At the south side of the Albert Dock basin, where electric cranes have recently replaced hydraulic ones, distribution is arranged by twin armoured cable along the face of the shed, with tee-offs at 50-ft. spacings to combined circuit-breaker and socket equipments. "Niphan" sockets have been fitted to the bottoms of these G.E.C. automatic-trip breakers by the P.L.A. engineers. A similar scheme at the south side of the Victoria Dock employs interlocked switches and plugs at the tee-off, and the main control for this system is a 500-A "Record" circuit-breaker complete with "in" and "out" bus-bar chambers, all in a sheet-metal case, made and installed by Electrical Installations, Ltd.

The pumping systems at the Docks are naturally of primary importance, and we intend to deal with these in a later issue.



Electrically Operated Plant at the London Docks

1. New cranes at the Royal Docks. 2. Four-unit suction plant at India Docks' granary. 3. The bascule bridge at the Royal Docks. 4. A banana elevator across a ship's deck. 5. Air compressors at the Albert Dock dewatering station. 6. The 90-kW generating set on the mammoth floating crane.

Kilovars—and Consequences.

By G. Maxfield, A.M.I.E.E.

Why they can be imported while kilovolts are being exported

WITH the advent of long high-power transmission lines the supply industry was presented with an entirely new unit, the kilovar or reactive kilovoltampere. The unit was adopted because it was essential for tariff purposes to be able to integrate reactive load as a separate entity and this type of meter satisfied the requirements of the commercial side. For a mental conception of the unit nothing more need be said than that a kilovar is a kilovoltampere at zero power factor. Most operators are by now quite accustomed to regulating export and import of reactive load, but some of the more abstruse aspects and peculiarities of performance are not yet sufficiently appreciated. Not only lines but transformers, generators, exciters, automatic voltage regulators, voltage wave form, metering, protective gear and switchgear rupturing performance are all involved in the problem of despatching reactive load equitably.

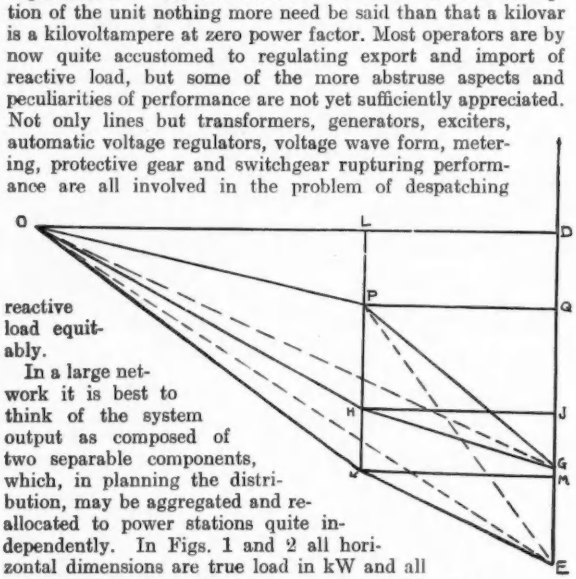


Fig. 1

In a large network it is best to think of the system output as composed of two separable components, which, in planning the distribution, may be aggregated and reallocated to power stations quite independently. In Figs. 1 and 2 all horizontal dimensions are true load in kW and all vertical dimensions are reactive load in kVA, the hypotenuse representing kVA in each instance. In Fig. 1 there are three conditions: (1) Normal; (2) station "A" taking more "line" from "B" (it is usual to think of leading kVA in equivalent miles of lines); (3) stations coupled by short line, station "A" being underexcited. Transference of kilovars (N.B.—there is no transfer of kilowatts) may be identified as follows:—The triangles LOK and MKE represent the consumers' loads of undertakings A and B. Generator loads are indicated under condition (1) by the triangles LOH for station "A" and by JHG for station "B." Under condition (2) by LOP for station "A" and QPG for station "B." Under condition (3) by LOP for station "A" and QPE for station "B."

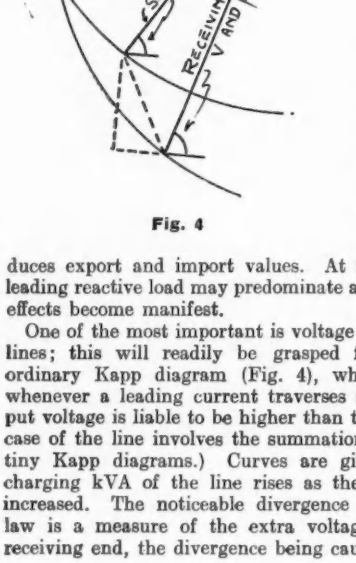


Fig. 4

In Fig. 2, since AB = CE the triangle OBC represents the values to be metered "as generated" and the triangles OFG and GDE "as consumed" by generating undertakings and non-generating undertakings respectively.

Fig. 1 will make it clear that it is possible (and the occasion frequently arises) to transfer all kilovars from one station to another, leaving the true load exactly as before. It is well at this point to examine the metering figure, No. 2, which introduces export and import values. At times of light load the leading reactive load may predominate and numerous secondary effects become manifest.

One of the most important is voltage rise along transmission lines; this will readily be grasped from inspection of an ordinary Kapp diagram (Fig. 4), which demonstrates that whenever a leading current traverses an inductance the output voltage is liable to be higher than the input voltage. (The case of the line involves the summation of a large number of tiny Kapp diagrams.) Curves are given showing how the charging kVA of the line rises as the length of the line is increased. The noticeable divergence from the straight-line law is a measure of the extra voltage to be found at the receiving end, the divergence being caused by each increment of line being charged to a higher voltage than the last. At no load the current at the sending end may be considerable whilst the current at the receiving end of the line is zero. This effect is best demonstrated by parallel feeders when one is alive to a distant point and the other is charged back from that point. If the incoming voltage is read on the open feeder it will be found considerably higher than the bus-bar pressure, although the transformers are on equal taps. If the first feeder is heavily loaded with leading kilovars, the fact that the transformers are on equal taps should be ignored; the second one should be paralleled according to voltage in the same manner as a generator, because the ensuing tap regulations, which gradually transfer the reactive load, actually oppose the idle circulation set up by the difference in ratios.

When dealing with leading kilovars the same conditions of "negative drop" will be found with transformers and alternators, and it is useful to compare the results of tap changes with those obtained when regulating alternators in parallel. In the great majority of cases tappings are on the high-voltage winding, No. 1 being full winding, the low voltage rising with the tap number (assuming fixed line voltage). In forecasting the swing of the generator power-factor meter there is much to confuse one, but, for facility in operation, it is necessary only to imagine the high-voltage side as another very large turbo, the low-voltage side as an alternator, and the tap change as a rheostat; the operator may then rely on his experience of alternators in parallel,

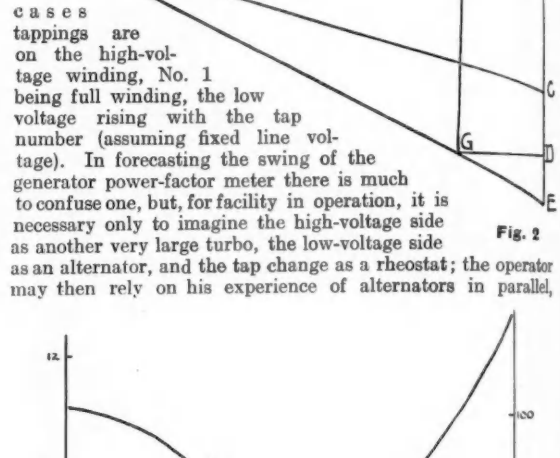


Fig. 2

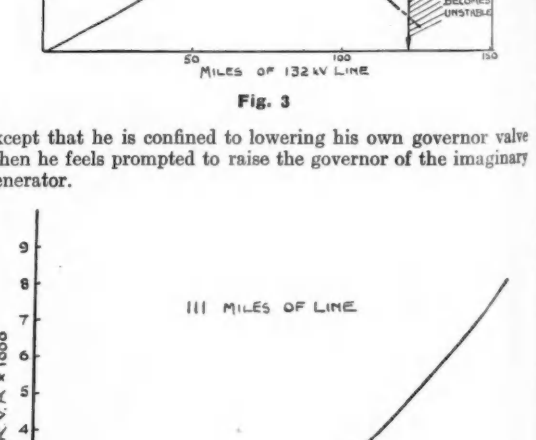


Fig. 3

except that he is confined to lowering his own governor valve when he feels prompted to raise the governor of the imaginary generator.

Fig. 5

The Certification of Meters

By J. W. Thomas, LL.B., A.M.I.E.E., Barrister-at-Law

ENGINEERS-IN-CHIEF and meter superintendents will at present be considering what administrative and technical changes will have to be made in their meter departments in order to comply with the new procedure for the certification of meters laid down in the Electricity Supply (Meters) Act, 1936, and no doubt they will have found by now that there are several points on which further elucidation is desirable.

It may be noted in the first place that meter examiners are to take the place of "electric inspectors" so far as the examination and certification of meters is concerned. They are to be appointed by the Electricity Commissioners; the power of appointment will not be exercised by local authorities. They are also to be paid such fees as the Commissioners prescribe.

According to Section 1 of the Act these meter examiners are to be competent and impartial persons and they are to be charged with the examination and certification of meters used or intended to be used in connection with the supply of electricity by authorised undertakers. It may be presumed that most, if not all, of them will be full-time officials, and it is obvious that if they are to discharge their duties in an impartial way they must be unattached to any undertaker whose meters are to be certified.

Functions of Examiners

There is scope for difference of opinion as to the precise meaning of the words "shall be charged with." A reasonable and permissible interpretation is that they are *to be responsible for* or *to be entrusted with* the examination and certifying of meters. In my opinion these words by themselves do not necessarily imply that meter examiners are to examine and test personally each meter before it is certified, otherwise one would expect the words to have been "shall examine and certify," as in Section 51 of the Schedule to the Electric Lighting (Clauses) Act, 1899. One might say that a station engineer is charged with the operation and maintenance of a generating station, but this does not necessarily imply that he must perform all the operations himself. One may reasonably conclude, therefore, that the words are intended to indicate the general functions which meter examiners are to perform under the Act. In exercising their powers and duties they are to be subject to the directions of the Electricity Commissioners. This clearly means that the Commissioners will have power to lay down the methods to be adopted by the meter examiners in discharging their functions and thus in effect the Commissioners will be the sole and final judges of the procedure for examining and certifying meters, subject to any specific and over-riding provisions in the Act.

It is obvious that in practice the precise definition of the functions of meter examiners will be important. If the strict view is adopted and it is decided that they must personally examine and test every meter before certifying it, this will involve the appointment of a small army of officials to keep pace with the output of new meters, the provision of more or larger testing departments, and considerable additional expense to undertakers. Most engineers will think that the other interpretation is the more reasonable and practicable one as it could readily be fitted in with existing arrangements. If it were adopted the procedure would probably be that the examiner would approve the method of testing and of recording tests by a particular authority, he would have access to all records and be afforded full facilities to examine and test personally any meter he chose at any time. In addition he would be empowered to exercise general supervision over the testing of the meters.

The same would apply in regard to the connecting of meters. This has become largely standardised so far as house service meters are concerned and all that need be involved is the approval of the method and liberty to inspect at any time the connections of any particular meter. It should not be necessary to inspect every meter on site, and in any case it does not appear to be called for under the Acts unless a special request is made. Special meters would no doubt receive individual attention.

To obtain more light on the matter, however, one must look at the other provisions of the Act. By Sect. 1, Sub-section 4, the examiners are to have the powers and duties conferred or imposed on electric inspectors by Sections 50, 51, and 57 of the Schedule to the 1899 Act. Sect. 50 indicates the requirements which must be satisfied if a meter is to be legally certified, *viz.*, it must be capable of ascertaining the value of the supply within such limits of error as may be allowed by the Electricity Commissioners and be of an approved construction and pattern. This section, in my opinion, does not impose specifically upon a meter examiner the obligation of personally examining and testing each meter but only of satisfying himself of its accuracy before he certifies it. There is no reason why he should not do this by the acceptance of records made in an approved manner by approved apparatus and not by actual tests taken by himself. In fact, there would appear to be nothing to prevent an examiner under this Section delegating the actual testing to some competent person; provided he is satisfied as to its accuracy he can certify it.

Personal Examination

The language of Section 51, however, is more explicit. It provides that if a meter examiner is required to do so by an undertaker or a consumer, *he shall examine any meter* and certify it if he considers it entitled to be certified. This seems to indicate that he himself must examine the meter and satisfy himself as to its accuracy. This provision applies to meters in respect of which the undertaker or consumer make a request and are prepares to pay the prescribed fee but as it is bound to be on the request of a consumer or undertaker, usually the latter, that a meter will be submitted for certification one may venture to suggest that this Section will apply to all meters which require certification before installation. This Section therefore may be taken as the main provision governing the method of examination and certification and, as indicated above, the language points to the necessity of some kind of personal examination being exercised by a meter examiner before he actually certifies a meter, though there is still room for doubt whether it is necessary for him to test it himself.

The effect of both the above Sections, taken in conjunction with Section 1 of the 1936 Act, seems to be that the manner of certifying meters which are to be installed on consumers' premises is a matter for the Electricity Commissioners who will issue the necessary directions to the meter examiners as to the discharge of their functions but subject to the over-riding provision in Sect. 51 of the Schedule that there must be a personal examination of the meters by the examiner. The extent and nature of this examination will be a matter for

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Kilovars—and Consequences. (*Continued from previous page*)

This method is applicable also to the case of two on-load tap-change transformers in parallel when the generating plant is shut down, the kilovar loading obeying what one would anticipate with alternator-rheostat regulation. The rule does not fail with leading power factors and, in all cases, the generator power factor will swing or tend to swing from lag to lead as the tap-change regulator is moved from a lower to a higher number—usually both clockwise.

By similar reasoning one may predetermine the direction of travel of the *nodal point of charging current when it is compulsory to close with a difference of voltage at a remote point of the network. On closing, the side which has the higher voltage will drop its charging current, the stations on the lower pressure side taking up extra leading kilovars until generators, transformers and lines find a fresh balance of voltage. The extra leading current traversing the reactance of the system on the lower-voltage side causes rise of potential as previously mentioned, thus dissipating a portion of the original difference. The remainder of the difference is taken up by an increased drop due to change in power factor (towards lag) of the plant on the higher-voltage side.

Fig. 3 gives the excitation current necessary to maintain the bus-bar voltage constant at the sending end. In extreme cases no excitation whatever is required, a condition to be combated, otherwise voltage control would be lost entirely at times of light load. This reacts on the performance of the automatic voltage regulator because the exciter is called upon to operate at a much lower voltage than was intended.

If a rotor resistance is used, the condition may be mitigated by running with the resistance "in," the position of the regulator being varied according to exciter output rather than by the generator output. More recent designs have embodied either an exciter stabilising field or, better still, an exciter the field of which is supplied from a constant-voltage pilot exciter. These machines invariably cope with a larger ratio of leading kilovars to alternator kVA rating without any ill-effects.

*The point of the line where the charging current is zero or which may be charged from either end in turn during fluctuation.

the Commissioners on which no doubt they will issue the necessary instructions.

In order that means shall be available for examining, testing and regulating meters, electricity undertakers must either provide themselves, or make arrangements with other undertakers to have the use of, suitable apparatus approved by the Electricity Commissioners and must ensure that the meter examiners have all the necessary facilities for the use of such apparatus.

The Appointed Day

These requirements must be carried out on or before the "appointed day," which is to be fixed by the Minister of Transport. From that date onwards all meters going into consumers' premises, unless otherwise agreed, must be certified in accordance with the provisions of the Act and will continue to be so certified unless any alteration is made to them, in which case they must again be examined and certified, as provided in Section 50.

Section 57 of the Schedule indicates the procedure for settling differences. It provides that where a difference arises between a consumer and undertaker as to whether any meter is or is not in proper order for correctly registering the value of the supply, or whether the supply has been correctly registered, the difference shall be determined by a meter examiner. In such a case the examiner would no doubt test the meter himself. This section, however, only applies to meters installed after the appointed day, as a new provision has been included in the 1936 Act for dealing with differences in respect of meters which were installed before the appointed day and were not previously certified by an electric inspector.

"Conclusive Evidence"

The register of a meter which has been certified in accordance with the provisions of the Act shall be conclusive evidence, in the absence of fraud, of the value of the supply. With regard to meters installed before the appointed day they shall be deemed to be proper meters for ascertaining the value of the supply and the register of such meters shall be *evidence* but not *conclusive evidence* of that value and they shall be regarded as certified meters. This is laid down in Section 3, Sub-section 1, and it is obviously to get over the difficulty raised by the case of Joseph *v.* East Ham Corporation. The position before the 1936 Act as revealed by that case was that if a meter was not legally certified, a consumer could refuse to pay for the amount registered by it and the undertakers had strictly no means of compelling him to do so. The onus was upon the undertakers to prove that the meter was certified, in which event the register was conclusive evidence, in the absence of fraud, of the value of the supply. If the undertakers failed in this, they had no cause of action against the consumer. This was also held in the case of Hendon Electric Supply Co. *v.* Banks.

The new Section has shifted the burden of proof from the undertakers to the consumer. Even if a meter installed before the appointed day has not been certified, its registration will be *primâ facie* evidence of the value of the supply used and the undertaker can demand payment on it. The consumer, however, can resist the demand by calling rebutting evidence that the meter was in fact inaccurate and if he succeeds he can avoid payment. But the onus of proving that the meter is not accurate is upon the consumer and the undertaker is not called upon to prove that the meter was certified if he can show that the meter was installed before the appointed day. In the case of such a difference arising the consumer would no doubt proceed under Section 3, Sub-section 2, as this sub-section applies to meters installed before the appointed day, whereas in the case of meters installed after the appointed day Section 57 of the Schedule applies.

This Sub-section 2 provides that where a difference arises between a consumer and an undertaker as to whether a meter is or is not in proper order for correctly registering the value of the supply or as to whether that supply has been correctly registered in any case by such a meter, then the consumer may serve a written notice to that effect upon the undertakers and the difference shall then be determined by a meter examiner appointed under the Act.

Certifying Existing Meters

By Section 3, Sub-section 3, a meter installed before the appointed day will cease to be regarded as a certified meter after it has been disconnected and removed subsequent to the appointed day or after the expiration of ten years from that day, and presumably if it is to be put into service again it will have to be certified in accordance with the procedure laid down in the 1936 Act. This provision will entail the removal and recertification within the next ten years of all meters at present installed in the premises of ordinary consumers. Some undertakers already make a practice of re-checking meters after ten years' service so that in their case no undue burden will be involved, but those undertakers who do not will have to consider making arrangements for giving effect to this provision. Possibly the best plan will be to take out, say, one-tenth of the installed meters each year so that at the expiration of ten years all of them will have been taken out and certified under the new Act. It would be impracticable to wait until ten years had elapsed and then attempt to certify all the meters in a year.

It is curious to notice that the ten-year period does not apply to meters installed after the appointed day, as Section 3 is confined only to meters installed before. Recertification of meters installed after the appointed day will, therefore, only be necessary if they have been altered in accordance with the provisions of Section 50 of the Schedule.

In the County of London electric inspectors within the meaning of the Schedule of the 1899 Act will continue to function and will not be replaced by meter examiners, in so far as the settlement of differences under Sect. 57 is concerned. In conclusion, it may be noted that the 1936 Act does not affect the right of the consumer and undertaker to agree that a meter need not be certified.

Generation and Supply at Hull

BRICKWORK maintenance has always been a large item in the boiler-house costs at Sculcoates, states Mr. J. N. Waite, the general manager and engineer of the Hull Electricity Department, in his annual report. This, he says, has now been reduced by the Department making its own plastic firebricks after extensive experiments to ascertain the essential qualities of a furnace lining.

Another point of interest in power-station practice is the action taken as regards chimney construction. Due to rapid corrosion of the steel plates it was found necessary to renew the five steel chimneys of No. 1 boiler-house, and the question of having short-lived steel chimneys again or of replacing them with brick or concrete ones had to be faced. A solution was found in the adoption of a heat-insulating, non-metallic lining for an ordinary steel chimney, and as the results of the experiment surpassed expectations all five chimneys are being treated in a similar manner.

In order still further to increase the boiler efficiency an experiment was made in increasing the surface of one economiser on the high-pressure boilers by 40 per cent. This was more successful than anticipated, and led to a decision to increase the surface of the economisers of the remaining four boilers to the limit of the space available, namely, about 60 per cent. each.

With the 25,000-kW turbo-generator, started last October, the capacity of the plant was brought up to 77,000 kW. and this will be further augmented next year by a new 30,000-kW set which is to replace one of 10,000 kW. The total output during the past year was 260 million kWh, an increase of 41.77 per cent. over the previous year. Of this amount 46 million kWh was exported to the C.E.B. Sales to consumers rose by 14.85 per cent. to 174 million kWh, the number of consumers increasing by 7,430 to 74,511.

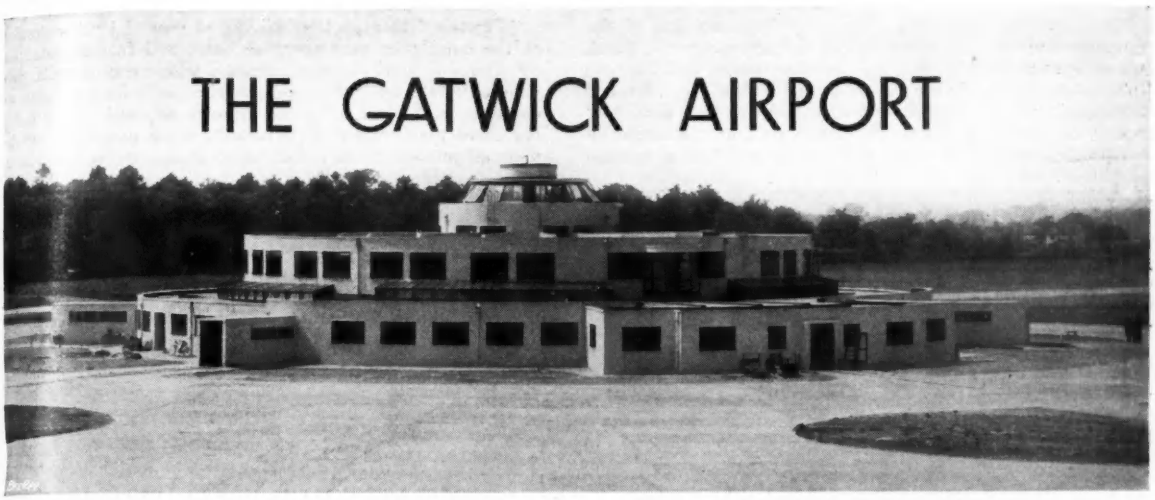
The development in electric cooking during the year was the largest since the commencement of the scheme. The number on hire and hire purchase connected in the period was 3,337, representing an average additional connection of twelve cookers per working day and an output of nearly three times the number of cookers in the preceding year. There were 12,010 electric cookers in commission at the end of March last. All returned due to consumers leaving premises, &c., were brought to the Department's workshops and reconditioned as new, so that not one has had to be scrapped. There was also considerable expansion in the numbers of water-heaters and wash-boilers supplied on hire and hire-purchase terms, especially wash-boilers (2,052 in use at March 31st last against 985 a year before). This rapid progress has been due largely to the very complete organisation that exists for sales promotion.

Extensive use is being made by the Department of electric vehicles, both on grounds of advertising value and inherent cheapness. Details are given in the report showing that with electricity at ½d. per kWh and petrol at 1s. 1d. per gallon the total costs per mile work out at 1.824d. (electric vehicle) and 2.415d. (petrol vehicle).

Prior to 1929 very little use was made of electricity for public lighting, but following a demonstration by the Department, at its own expense, rapid conversion has taken place. At March 31st there were 4,724 electric street lamps within the city (against 6,268 gas), 634 having been installed in the twelve months. In addition, there were nine miles of roadway electrically lighted outside the city boundary.

There was a net surplus on the working of the undertaking of £41,704, against £61,714 in the previous year. The effect of reductions in tariffs meant a loss of income to the Department of £23,000.

THE GATWICK AIRPORT



A RECENT visit to the new Gatwick Airport, by the courtesy of Airports, Ltd., has left us with a firm impression that in no other field of development for the lighting engineer—in factory, shop or school—is the utility side of electric lighting so marked as it is in the aerodrome. The airport beacon, obstruction and boundary lights, wind direction indicator and landing floodlights are all specially designed and "self-contained" equipments that are highly creditable to electrical manufacturers.

The code signal ("G") allotted to the airport is "flashed" in morse by a 3-kW neon beacon mounted on a platform 40 ft. or so above ground level. The beacon proper consists of six hairpin bend neon tubes built up around a metal frame in the form of the frustum of a cone. It is normally visible for 50 miles, and the code is signalled continuously under the control of a motor-driven flasher which, in the event of failure, leaves the beacon "on" as a permanent light.

Outlining the aerodrome, with equal spacings, are the boundary lights, each with a 6-V lamp fed from its base-isolating transformer in a series supply circuit. The waterproof assembly of the inverted glass globe and the provision of stems which are easily broken in the event of a collision are notable features of these boundary-indicating lights.

Most of the obstruction lights are mounted on lattice steel masts varying in height from 20 ft. to 50 ft., according to the heights of the obstructions—here the hangars and there some trees. In these 60-W lamps are employed, covered by red globes. On the wind tee, with slip-ring and brush gear in the pedestal to provide the necessary "free" connection for movement of the indicator portion under wind influence, there are 40 lamps, 20 on each arm, and we learnt that 15-W lamps are employed because they give a clear-cut tee as compared with the somewhat blurred pictures resulting from the use of higher-wattage lamps. The beacon, obstruction and boundary lights and the wind tee were all supplied by the General Electric Co., Ltd.

For night landing permanent-installation floodlighting has been adopted, instead of the portable equipment used elsewhere. There are three such installations at different points near the aerodrome boundary, so situated and of such illuminating capability that each one will adequately flood the drome for a plane landing from a given direction. Each flooding equipment has four projectors arranged side by side within a metal cabinet measuring about 20 ft. by 6 ft. by 2 ft., with glass doors at the front and solid doors at the back.

The lighting unit of each projector is a Siemens 1,500-W m.f. lamp, at the back of which is a large reflector made up of six pieces of glass so that the whole presents a concave surface to the lamp, while immediately in front of the lamp are two small adjustable metal shields forming a "back-throw" reflector. The two outside projectors and their windows are set back at a slight angle from the vertical plane of the two centre units.

Each complete floodlighting equipment (four projectors) has an intensity of 1½ million candle-power. The landing lights are products of Messrs. Chance Bros., Ltd. When a plane taxis towards the terminal building it receives instructions as to the berth at which it should stop from a direction indicator on which appears at the will of the control officer any one of the berth numbers. These figures are shown by an illuminated-cell type of sign at the point of an arrow and complete the message "Follow Outer Circle to Berth." This wording is illuminated by three Benjamin "Crysteel" reflectors bracketed at the top of the triangular structure, which is mounted on wheels. This direction indicator was supplied by Messrs. Troughton & Young, Ltd., who were responsible for the general installation work at the airport.

Benjamin reflectors within the hangars at 26 ft. spacings and at a height of 26 ft. provide really excellent light intensity at the working plane, while reflectors of similar make light the concrete aprons in front of the hangars to a distance of 60 ft. for the purposes of repair work and refuelling at night.

Above: The hangars, showing the neon beacon in rear. Right: The control tower at night

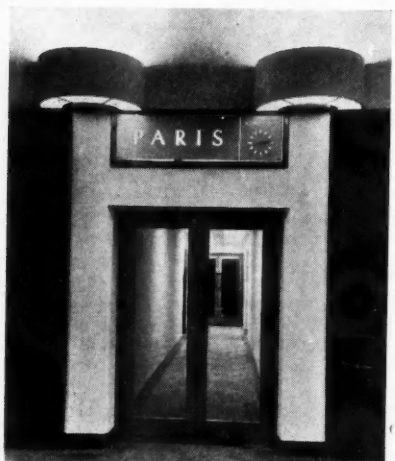
The airport is adjacent to the main Brighton line of the Southern Railway, and after walking through a subway, which we entered actually within the railway station building, we found ourselves inside the airport terminal building. At about 27-ft. spacings facing pairs of lighting "units," consisting simply of lamps recessed in the tunnel wall, each enclosed by a framed frosted glass flush with the tunnel lining, provide

"Tunnels" through the building at ground level, extended at the outside by permanent sections, and further extended by telescopic fabric-on-metal sections which run on rails, provide complete covered-in gangway communication between concourse and plane. Various types of recessed ceiling lighting serve the permanent portions of these gangways, whilst a complete reversal of the order of things is the solution to

Left: One of the landing floodlights. Right: The well-lighted subway from the railway station to the terminal building

adequate illumination, while here and there are showcases with simple bowl reflector fittings welled in the roof.

The design of the terminal building is striking and must have set the lighting engineer some unusual problems. He has certainly solved them very effectively. All within the one covered structure there is a circular three-storey block at the centre surrounded on the ground floor by a wide concourse outside of which is a ring-shaped portion of the building. The inner portion of the ring is in two storeys, so that the whole building presents a tiered circular exterior with the control room at its centre and summit. In sector shapes and modifications thereof the central and ring portions accommodate rooms and compartments for Customs examinations, freightage, stores, offices and shops and also for a restaurant served by an all-electric kitchen. Among the items that we saw in this kitchen are a steaming oven, a two-tier pastry oven, a double-oven heavy-duty cooker complete with hotplates, a double-compartment griller and a warming cupboard with a bain-marie, all of G.E.C. manufacture, a large B.T.H. refrigerator, and a cooling cabinet with a compressor unit, mainly for the purpose of temporary bottle storage, which was supplied by the Controlled Cooling Co.

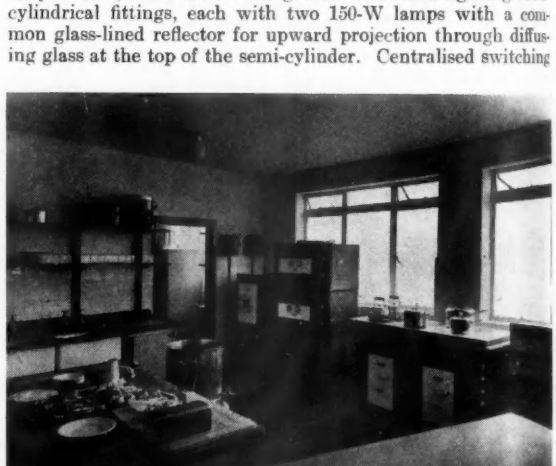


Lighting fittings, clock and indicator panel over one of the entrances in the concourse

By far most of the lighting of the building is provided by the now popular totally enclosed spherical lighting fitting in various sizes and with different methods of suspension. In the kitchen, for instance, the spheres are fixed close up to the ceiling, while in some of the offices they have pendant "drops" of a few feet. In some of the narrow corridors "flattened-out" globes fixed direct to the ceiling represent a modification of this scheme, while in some of the stairways we saw chromium-plated metal bowl reflectors bracketed to the walls. Circular pieces of glass flush with the ceiling are all that can be seen of some of the lighting "units" serving open-fronted compartments of the central block which appear to be, in effect, recesses from the concourse.

the ticklish problem of lighting the fabric gangways when they are de-telescoped. A flush circular glass in the concrete floor covers a recessed lighting unit for upward distribution.

Over the entrances and exits in the concourse are destination signs and clocks, the lighting unit of each being a length of ordinary illumination strip behind a ruby glass panel. Similarly located, there are for the general concourse lighting semi-cylindrical fittings, each with two 150-W lamps with a common glass-lined reflector for upward projection through diffusing glass at the top of the semi-cylinder. Centralised switching



A corner of the all-electric kitchen

for the concourse and tunnel lighting is arranged from a point in the central portion of the building, while in the control room, where we saw Marconi transmitting, receiving and direction-finding radio apparatus, remote control is provided for the obstruction and boundary lights, the beacon and the floodlights. With the exception of the beacon, the simple remote control switches for all these equipment groups govern operating contactors in the basement.

Refining Aluminium

Electrolyte containing a substantial quantity of barium chloride is used in a new process for refining aluminium that has been developed by the Compagnie de Produits Chimiques et Electrométallurgiques Alais, Froges et Camargue and which has been put into use at the company's Jean de Maurienne plant. The *Chemical Trade Journal*, which gives this information, states that a typical mixture consists of 23 per cent. aluminium fluoride, 17 per cent. sodium fluoride and 60 per cent. barium chloride. The advantage of this electrolyte is said to be its comparatively low fusion point, the material being in a suitably fluid condition below 750 deg. C. The anode efficiency is 100 per cent. and that of the cathode 97 per cent., the working temperature being 750 deg. C. The bulk of the aluminium produced is said to have a purity of 99.995 per cent., but 99.9986 per cent. purity can be obtained.

Circuit-breaker Testing.

By C. C. Garrard, Ph.D., M.I.E.E.

What manufacturers' proving-houses are revealing

NEXT to producing an electric current the most fundamental problem of electrical engineering is that of closing and opening a circuit. It is curious that the theory of the apparatus for performing the latter operations should have lagged so far behind that of machines for the production and use of electricity. Whereas the theory of electrical machines was well established within the first decade of this century, it was not until about ten years ago that any attempt was made to place the construction of circuit-breakers upon a sound theoretical basis.

The experimental investigations necessary to this end are still proceeding actively in many countries, but the dissemination and co-ordination of the knowledge that is being obtained is somewhat hampered by the fact that all the short-circuit testing plants at present in existence are the property of individual firms, so that the results that they obtain do not always become immediately available to the general public. A certain amount of valuable co-operative investigation upon circuit-breaker design is, of course, carried out by the British Electrical Industries Research Association, but its volume is not sufficient to invalidate the above remarks.

It is interesting, in this connection and in the light of the experience that has been obtained recently in the operation of short-circuit testing plants, to re-examine the proposal that was made some years ago to lay down a central circuit-breaker proving house to which all manufacturers would send their apparatus for testing.

At the time, the scheme was not proceeded with for various reasons, a circumstance which was lamented in many quarters. Coming back to the question to-day, however, one cannot help feeling that the establishment of a central testing station, necessarily remote from the works of the majority of manufacturers, while it might have been valuable from the point of view of co-ordination of effort, would have greatly increased the trouble and expense of developing new lines of breakers. It was, in fact, a mistake to think that circuit-breakers could be built and then tested out once and for all in the same way, for instance, as a chronometer is sent to Greenwich.

Circuit-breaker development is a long and frequently arduous process, consisting even to-day largely of trial and error, which it is only possible to carry out effectively if the testing station is in close proximity to and works in active collaboration with the drawing office and factory.

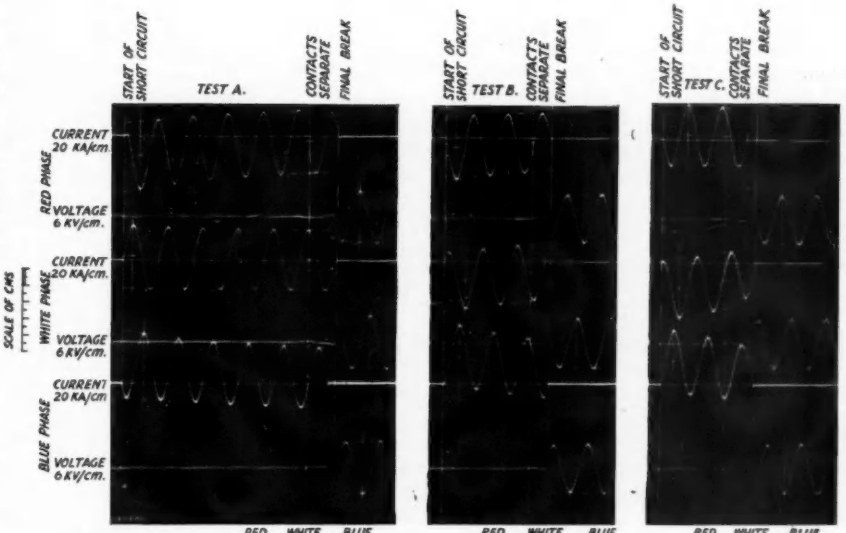
Circuit-breaker Specifications

While it is already impossible to sell large circuit-breakers unless a certificate of test from a short-circuit testing station is available, it would not be true to say that universal agreement had been reached with regard to the manner in which breaking capacity should be defined and specified. Discussions upon the subject are proceeding in all countries and also internationally through the I.E.C. There is, unfortunately, a tendency in these discussions to devote much attention to abstruse points of theory, while agreeing to differ upon questions of more fundamental importance.

It is, for instance, proving difficult to arrive at agreement as to whether the total short-circuit current interrupted by a breaker or only the alternating component of this current should be used to calculate the breaking capacity. This is an exceedingly important question, as it influences not only the breaking capacity which may be assigned to a given breaker, but also, for the larger sizes of breaker, the size of testing equipment necessary and the cost of testing.

It is, in my opinion, singularly unfortunate that there is a tendency on the part of those concerned to shelve this question, or to adopt as a solution the expedient of having two different specifications, one based upon the total current and the other upon the alternating component, leaving the buyer and maker to settle between them to which specification they will work. There is little doubt in my mind that the correct procedure is to base the calculation of breaking capacity upon the total current. The total current and not the a.c. component of the current, in fact, determines the thermal and electromagnetic stresses upon the breaker, the burning of the contacts and to some extent the arc energy. There is direct evidence, as is shown, for instance, by the accompanying oscillograms, that as far as oil circuit-breakers are concerned tests involving a given alternating component of current are more severe upon the breaker when a large d.c. component is present than when the current is more nearly symmetrical.

These three sets of oscillograms were taken during tests of a 500,000-kVA, 11-kV oil circuit-breaker. As regards the alternating component of the current broken, there is not much difference between the three tests. Test C, however, has a large d.c. component in two phases, whereas test B has a large d.c. component in one phase only, and the d.c. components in test A are all small. Calculated according to B.S.S. 116/1929, *i.e.*, taking into account the total current broken, the kVA broken was about 8 per cent. greater in test C than in tests A and B. This is reflected by the behaviour of the breaker, which was heavier on C than on A and B; this was confirmed by the measurements of arc energy, which are not shown.


START OF SHORT CIRCUIT
CONTACTS SEPARATE
FINAL BREAK
TEST A.
TEST B.
TEST C.
RED PHASE
WHITE PHASE
BLUE PHASE
CURRENT 20 KA/cm.
VOLTAGE 6 KV/cm.
SCALE OF CMS
RED WHITE BLUE
CURRENT BROKEN (RMS AC COMPONENT, KA) 26.4 25 25.2 | 24.3 23.4 24.* | 24.9 23.8 24.1
PERCENTAGE D.C. COMPONENT 14.8 4.25 23.8 | 14.6 36.4 60 | 12.8 61 55.9
KVA BROKEN CALCULATED ACCORDING TO BSS 116/1929 KVA 506100 505000 544800
BEHAVIOUR EASY EASY FAIRLY HEAVY

Oscillograms taken during tests of a 500,000-kVA, 11-kV oil circuit-breaker

It may also be shown from a more theoretical point of view that if a "severity factor" is used to define the severity of short-circuit tests, as has been proposed recently, for example, by Mr. C. J. O. Garrard, the increase in severity due to the increase of the total current corresponding to the d.c. component more than compensates for the decrease in severity which is due to the presence of the d.c. component shifting the current zero at an instant at which the instantaneous value of the recovery voltage is not a maximum.

Restriking Voltage Problem

The most difficult problem in connection with circuit-breaker specifications that remains to be solved is to determine the influence of the rate of rise of restriking voltage upon the severity of the tests. This question is complicated by the difficulty of defining the quantities under discussion and of separating their effects from those of other variables both known and unknown. The study of this question is now at a stage at which its complication appears to grow with each new fact that is brought to light. No complete explanation of it or of the related problems of post-arc conductivity and the supply of energy to the arc is likely to be obtained without a considerable amount of research on the physics of high-power arcs. This will necessitate close co-operation between physical-research institutions and the owners of short-circuit testing laboratories. Such co-operation could not but be of value to manufacturers, for if they are to be in the forefront of technical development they must be well abreast of physical research.

The immediate need is for an agreed specification which, if not technically perfect, will at least tide over the period which will certainly elapse before all the phenomena of circuit-breaking are understood. For this I suggest that a rating based upon the product of the total current and the recovery voltage would be most satisfactory; at the same time it should be specified that the test power-factor should be low (say 0.15). Questions of natural frequency and rate of rise of re-striking voltage might very well be left for consideration when our knowledge of the phenomena has increased.

In this connection it is interesting to compare the magnitude of the effect upon the rating of a breaker of taking account (as best we can now) of various factors such as natural frequency and rate of rise of restriking voltage, with the accuracy of measurement that can be obtained with the oscillographs used in modern testing stations. The accuracy with which the oscillograph curves can be read is about 5 per cent., so that the accuracy of the kVA rating deduced from readings of the voltage and current curves is about 10 per cent.

Now suppose that a three-phase test is made with a given symmetrical current and a given recovery voltage and that its severity is taken as unity. If now the test is repeated with the same alternating component as before, but with direct components of 20 per cent. in one phase and 10 per cent. in the other two, the severity is increased to 1.02. If the direct components are 50 and 25 per cent., respectively, the severity is 1.12. These figures are calculated according to the method proposed by Mr. Garrard (referred to above) and take into account only the increase in severity due to the increase in the total current produced by the direct component. If the decrease in restriking voltage due to the same cause is considered also, the above figures for the severity of the two tests are reduced to 1 and 1.02, respectively. These figures show that as long as the direct component does not exceed about 50 per cent. its effect upon the severity of the test is little greater than the limit of error of the measurements.

Work for Testing Stations

The capital and running costs of a short-circuit testing station are so high that great care must be taken to keep it fully occupied. The preparation of the apparatus to be tested is also very often a lengthy process, so that smooth working can only be obtained by very careful organisation and planning.

Besides the routine work of testing completed circuit-breakers and switchgear units, there is development work on new designs and general experimental work on circuit-breakers to be carried out. A further class of work that must be undertaken by a short-circuit testing plant is the proving of the short-time current rating of components other than circuit-breakers. Bus-bars, cables, cable joint and sealing boxes and current transformers all have to withstand the thermal and mechanical effects of the short-circuit currents. At the moment there is a tendency to neglect these components, and in particular many current transformers being made to-day are insufficiently robust to stand up to heavy short-circuits.

It is difficult to design wound primary current transformers (for, say, 300 A or less) of high short-circuit current carrying capacity, and where the short-circuit current is of the order of 50,000 A or over, the greatest care must be exercised to ensure that the section of the copper is adequate and that the coils and end connections are thoroughly well braced. Square or rectangular coils should be avoided at all costs, and wherever possible it is much better to use bar primaries.

The practice of choosing cable sections with regard solely to the heating on normal full load leads frequently to sizes being installed which are inadequate to deal with short-circuit currents.

Some Results

The first task that falls to any testing plant in the early years of its existence is to carry out tests upon existing ranges of apparatus with a view to establishing the guarantees which previously may not in all cases have been based upon tests. It is a tribute to switchgear manufacturers that since the establishment of testing stations in this country no drastic changes of design or revolutionary alterations have been found necessary in order to meet guarantees that for a large part were given before the test plants were in existence. This shows that the policy of robustness and sound mechanical construction, which has been characteristic of British switchgear manufacture, was a good one. The only case in which more conservative ratings have been shown to be necessary is that of circuit-breakers for low voltages. A short time ago it was not generally realised to what extent the mechanical strength of current-carrying parts, insulators and mechanism limits the current that can be dealt with by a circuit-breaker. A 10,000-kVA, 440-V breaker must deal with the same current as a 1,500,000-kVA breaker at 66 kV. Even when allowance is made for the smaller clearances of the low voltage breaker, the difficulty of building 440-V breakers for 25,000 kVA or higher capacities can easily be recognised.

One is often asked why it is that, in spite of the somewhat tardy establishment of testing stations in this country, so few serious breaker explosions or breakdowns have ever occurred. The main reason for this is undoubtedly that given above, namely, that British switchgear has been for many years soundly constructed and conservatively guaranteed. In addition, close interconnection of generating stations, which was common practice in Germany, for instance, ten years ago, has been achieved in this country only much more recently. We have been able to profit by the general development of switchgear technique in the intervening decade, and also to some extent by the experience of other countries, so that to a very large extent our power stations were already equipped, when the time came to interconnect them, with apparatus that was capable of standing up to the increased severity of duty.

It is, of course, true that on some occasions undue optimism in guaranteeing breakers was offset by too great pessimism in calculating the short-circuits to which it was expected to subject them. Now that circuit-breakers can be more exactly rated, it behoves users to increase the accuracy of their calculations in order to avoid the risk not only of under-dimensioning but also of the over-dimensioning which may occur if reliance is placed upon large factors of safety rather than upon sound calculation from accurate data.

Electricity Supply in Nigeria

VERY gratifying results are recorded in the annual report of the Electrical Branch of the Public Works Department, Lagos, Nigeria, which the electrical engineer-in-chief, Mr. C. H. Pickworth, has sent us. In spite of reduced demands for electricity at the colliery and railway workshops at Enugu and Kaduna and of the delay with the installation of new revenue-producing works, the combined revenue (£115,411) of the four undertakings of Lagos, Port Harcourt, Kaduna and Enugu for the year ended March 31st last exceeded expenditure by £30,380; this represents a return after putting aside £17,126 for depreciation of 7 per cent. on the reconstructed capital of the undertakings. The actual net profit was £10,546.

Approval was given during the year for the Electrical Branch to take over the management and operation of the Kano Native Administration electricity undertaking and also of an electricity scheme under construction for the Egba Native Administration at Abeokuta, where supply commenced in June, 1935. An electricity scheme for Calabar, estimated to cost £18,300, has been prepared, but no further action has been taken with regard to the schemes put forward in the previous year for Ibadan, Vom and the Iju waterworks. The scheme proposed for Jos was approved in September, 1935, and a £42,000 extension of the Lagos power station is proposed, providing for the installation of a 4,000-kW turbo-alternator, a 40,000 lb. per hr. boiler with ancillary plant, and coal conveying and handling plant. A further extension at Lagos is planned within the next few years, including two more boilers, a duplicate turbo-generator and a new switchhouse.

Better quality coal and increasing load have effected a considerable reduction in costs at Lagos, the consumption of coal in 1934-35 averaging 3.63 lb. per kWh generated as against 3.9 lb. for the previous year. Scrap wood from saw mills used during periods of light load have contributed to a large saving in fuel.

The demand for cookers, water heaters, ceiling fans and refrigerators is continually ahead of supplies, while the popularity of other apparatus is maintained. At Lagos and Enugu the consumption of electricity for domestic purposes has increased over 30 per cent., and there is a 40 per cent. increase at Port Harcourt and over 250 per cent. at Kaduna. Domestic refrigerators account for a considerable proportion of these increases, over 600 machines being in use in Lagos alone.

The numbers of consumers now connected are as follows:—Lagos 5,606 (1,307 increase during the year), Port Harcourt 1,109 (523 increase), Kaduna 944 (374 increase) and Enugu 1,931 (793 increase). The total kWh of electricity sold in 1935-36 was:—Lagos 5,238,557 (against 4,818,464), Port Harcourt 406,119 (314,495), Kaduna 516,944 (486,754), and Enugu 1,204,469 (1,314,641).

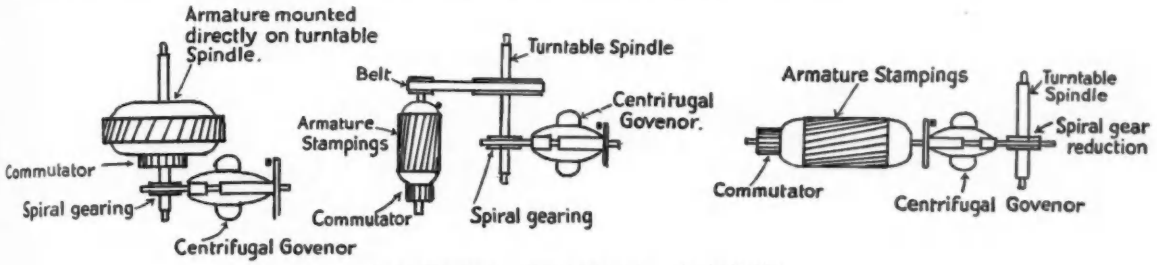
Small Commutator Motors.

By E. C. Wadlow, Ph.D., B.Sc.

Their use for driving gramophones

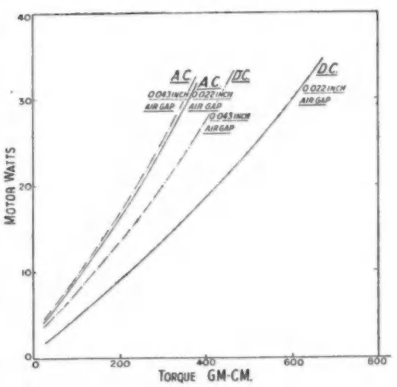
A MOTOR designed specifically for one application is often useful in others, but difficulty is sometimes experienced in obtaining data showing its normal behaviour. In the following notes, in the preparation of which I have been accorded facilities by the Gramophone Co., Ltd., the general performance of small series commutator motors as used in gramophones is briefly described.

The chief advantage of this type of motor is its ability to work on both d.c. and a.c. supplies. For the former, it is the only one available, while on the latter it is capable of working satisfactorily over a much wider range of frequency than any other type. A single series-wound commutator motor can be made to operate successfully as a gramophone motor on all d.c. voltages and on all a.c. voltages and frequencies in this country, if used with a variable resistance to provide the appropriate voltage at the motor terminals. A cheaper motor with a more restricted frequency range on a.c. results if the separate resistance is dispensed with and the coils of the motor are connected in various ways to provide alternative impedance values.



Motor diagrams. No field system is indicated

The armature may be either directly attached to the turntable spindle when it normally revolves at 78 r.p.m., or it may run at a higher speed and drive the turntable spindle through a belt or through tooth gearing. The speed controlling device is a small centrifugal governor running at about 1,100 r.p.m.



Effect of air gap length on the performance of a universal commutator motor. A.c. tests carried out on 50 cycles. All measurements made at 200 r.p.m. of armature

In the cases illustrated the armature speed is so low that the back e.m.f. is practically nil, and in laying out a design it is necessary to assume that on d.c. the current taken is determined directly by the applied voltage and the measured d.c. resistance of field coils and armature. On this account fine wire has to be used for motors working directly on 250 V d.c. in order to get adequate resistance values. This is avoided when an external resistance is employed. The motor is then wound to work directly on the lowest d.c. voltage and the wire is large in diameter, cheaper per lb., and more easily handled. However, although the performance may be improved and equalised for all voltages and frequencies, the total cost is generally higher.

If a separate resistance is not used, the motor must be capable of developing a minimum torque of about 400 gm. cm. —measured at 78 r.p.m.—on the lowest voltage at the highest supply frequency; there is sometimes difficulty in getting sufficient torque on the lowest operating voltage and sufficiently cool running on the highest.

Although the duty is practically standardised, motors produced during the course of the past five years have shown wide variations in size and performance. Thus, in thirteen designs examined the value of the product D^2Ln (D=armature diameter in inches, L=armature length in inches, and n=r.p.m.) for the armature varied from 624 to 4,660. The lower values generally were associated with slow-speed motors. The torque at the 78 r.p.m. spindle on d.c. for an electrical input to the motor of 10 W varied from 440 gm. cm. to 1,350 gm. cm. In terms of efficiency, figures correspond to from 3.5 per cent. to 10.8 per cent. on d.c. and from 2.2 per cent. to 9.2 per cent. on a.c., 50 cycles. When the factor torque (gm. cm.) for 10 W input/D^2Ln is calculated the values range from 0.18 to 1.04 on d.c. and from 0.16 to 0.64 on a.c., 50 cycles. The highest values for this factor are generally given by the motors which run directly at turntable speed and thus avoid gearing or belt losses, and which benefit from lower brush losses owing to the reduced peripheral speed of the commutator.

For gramophone work, low value of torque per 10 W/D^2Ln is not necessarily a criterion of excellence. In any case, the power consumption is so small as to be negligible, and points of greater importance are universality, smooth and quiet running and freedom from brush trouble.

The requirements for universality and efficiency are diametrically opposed. Efficiency calls for small air gaps, but if these are used the reactance of the coils is greatly increased when the motor is used on a.c. and the difference in performance on a.c. and d.c. becomes more pronounced. These considerations usually determine the gap length, which is never below 0.015 in.

So few direct-drive motors have been made that there is no such thing as standard practice, but with the type driving the turntable spindle through a gear ratio of about 14 to 1 there is a fairly marked uniformity. The armatures have a diameter of about 1.5 in., a length of about 1 in., generally twelve armature slots, twice as many commutator segments and a simplex lap winding.

The reduction in selling prices which has occurred during the past few years has resulted in the elimination of some of the refinements and the substitution of cheaper materials. It is usual now to wind armatures with enamelled copper wire whereas silk-covered wire was once used. Also, enamelled-copper wire has displaced cotton-covered wire for field coils. Other refinements of an earlier motor are indicated in the following specification: armature diameter 1.75 in., eighteen armature slots, thirty-six commutator segments, armature speed 1,100 r.p.m., field poles chamfered to give an increasing gap under the poles tips and slotted up the centre to increase the cross reluctance. With an air gap of 0.030 in. each side this motor ran almost as quietly on a.c. of any frequency up to 100 cycles per second as it did on d.c. This performance cannot usually be obtained from cheaper designs where excessive noise on a.c. and insufficient torque on 100 cycles are the limiting features.

With the slow-speed motor running at 78 r.p.m. trouble is usually experienced on 25 cycles due to torque pulsation. On a.c. the torque falls to zero twice during every cycle, and the pulsation is most noticeable if the moment of inertia and speed of the armature are both low. Indeed, it may prevent a motor from being usable under these conditions. The large diameters necessary may also be troublesome on higher supply frequencies when the vibrations, now in the audible range, are readily radiated by the flat constructions generally imposed by space considerations.

Brush noise is one of the most difficult to eliminate, and it generally becomes more pronounced with use. Slow speeds have an advantage here as the brushes and commutator then have an almost unlimited life. Commutators with mica-bar separators and moulded bakelite centres are usual, and are quite suitable for this light duty.

Good commutation and freedom from sparking are essential with a gramophone motor. Interference between the motor and the amplifier due to sparking at the brushes is met either by placing a single condenser across the brushes or by using a centre-tapped condenser, the centre being earthed.

Commutator motors are not, however, desirable for gramophones, as on a.c. they are inferior to other types in first cost, performance and trouble-free life.

Correspondence

Contributions from readers are welcomed. The writer should give his name and address, not necessarily for publication

Oil Circuit-breaker Faults

The Home Office Report of Electrical Accidents in 1935 which was discussed in your leading article last week must intensify the distrust which operating engineers are feeling towards the oil circuit-breaker under heavy-duty conditions. The case of a modern circuit-breaker which had survived a type-test of 250,000 kVA, but which nevertheless failed at something less than 80,000 kVA, is particularly disturbing.

As a non-specialist, it appears to me that the ability of a breaker to withstand a test of 250,000 kVA under service voltage at a switchgear testing station may not provide even an approximate indication of the kVA which might destroy that same switch under service conditions when, during the process of opening, it may receive a transient pressure-rise emanating from the very fault it is attempting to clear.

In order to make our oil switches stand up to their increasing duty we are continually adding to their strength to resist explosion. The result is that when they do explode they do so with increasing violence and danger to life. This process may well go on until oil switches with any appreciable capacity behind them will all, as a matter of routine, be remotely operated and housed in explosion-proof chambers.

Is it not time that more attention was directed in this country to the various forms of oil-less circuit-breakers which I understand are being intensively developed and widely applied on the Continent? DUTY-CYCLE.

August 7th.

Penalising the Industrial User

On reading the article under the above heading in your issue of August 7th I was astonished that the REVIEW accepted such an article for publication. It is misleading, the figures on which the examples are based are not representative of normal tariffs for power purposes, and the writer appears to ignore the important part played by diversity in the economics of electricity supply.

If the author had made it clear that his figures and arguments related to a particular undertaking one could have sympathised with him for being unfortunate, but when he attempts to argue that power supply is penalised to give a cheap supply for domestic purposes as a normal practice, it is time to state quite clearly and emphatically that this is not the case.

It should also be pointed out that, in the first comparison, the author uses total installed capacity as the maximum demand to calculate the annual load factor, and compares this with a factory where the actual m.d. is taken as the basis. It is obvious that the two load factors are not comparable.

The author's facts are not good arguments for his general proposition that power supply is used to subsidise domestic supply. The only thing the facts do show is that the price paid for power in his particular case is much higher than would be the case in the majority of undertakings. For instance, in Hull he would pay not more than 0.785d. per kWh for his power, instead of the figure of 2.9d. given in his article; and he would not be called upon to provide any switchgear or transformers, except for his own use.

Arguing from the particular to the general is notoriously unsound. Perhaps the REVIEW will give Mr. Strode information on the influence of diversity on tariff standing charge.

Hull, *August 10th.* J. N. WAITE,
General Manager and Engineer,
Electricity Department.

[The relationship between the two loads was discussed in our leading article of April 17th.—EDS., ELEC REV.]

In your issue of August 7th you publish a letter headed "Why Standardised Tariffs?" and an article "Penalising the Industrial User," which at first sight appear to have no connection. In fact, however, there is a close connection. Both illustrate the ridiculous outlook which is one of the most important of the many things wrong with the supply industry.

The article quotes a specific case, but statistics show that on any system of importance the domestic consumer who uses, say, 1,500 or more kWh per annum, buys it at less than the grid price to the supply undertaking.

Mr. D. J. Bolton shows in the ELECTRICAL REVIEW of September 20th, 1935, that the average revenue from generation and distribution is 1.33d. per kWh. During 1935 you published many letters from consumers who paid considerably less than one penny per kWh, and I am confident that very few of your readers pay 1.33d. or more for their domestic consumption. In addition, they may hire apparatus at a figure which does not cover the expenses involved in providing it.

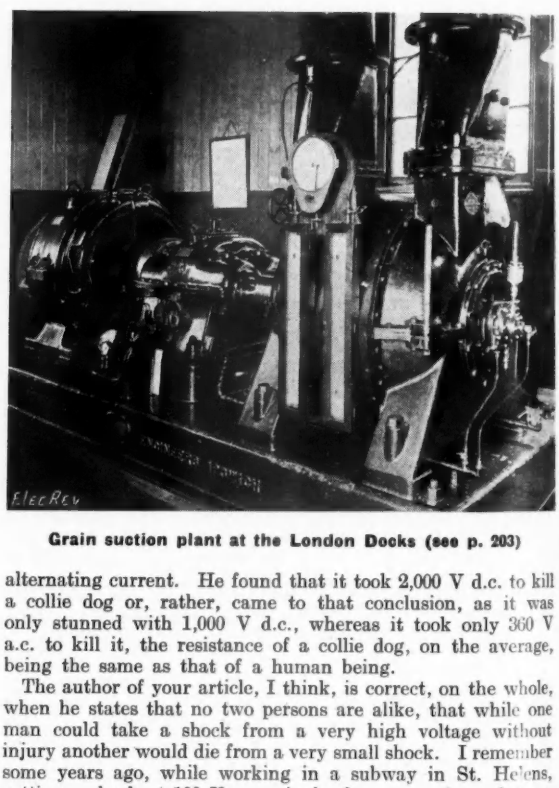
It is obvious, therefore, that the fortunate person who can afford to pay more than about 2s. 6d. a week for electricity is subsidised, first by the industrial consumer and secondly by the unfortunate person who cannot afford 2s. 6d. a week, no matter what comic tariff is offered.

In his letter "Variety" makes a number of points, most of which are perfectly correct, but his ideas appear to be based on the supposition that the supply industry exists to sell electrical energy. This is the root cause of all the trouble. Electricity suppliers ought to exist to sell electrical service, and until they realise this fundamental idea and base their policy on it they will never get out of their present chaotic state and give us what we want, namely, the benefits of electricity at a fair price. N. F. SAUNDERS.

Ruislip, *August 10th.*

What is a Safe Voltage?

I was interested in Mr. Gilbert's article in your issue of July 31st on the subject of safe voltage. Some years ago (about 1888-89) an article appeared in the New York *Electrical World* on the dangers from electric shock. The article was written by a Professor of Columbia University, in which he described some experiments which he had carried out himself on dogs and was a bit of propaganda against the change-over which was then taking place in New York from direct to alternating current. He found that it took 2,000 V d.c. to kill a collie dog or, rather, came to that conclusion, as it was only stunned with 1,000 V d.c., whereas it took only 360 V a.c. to kill it, the resistance of a collie dog, on the average, being the same as that of a human being.



Grain suction plant at the London Docks **(see p. 203)**

The author of your article, I think, is correct, on the whole, when he states that no two persons are alike, that while one man could take a shock from a very high voltage without injury another would die from a very small shock. I remember some years ago, while working in a subway in St. Helens, getting a shock at 100 V a.c., single-phase, transformed down from 10,000 V a.c. I could not let go and only my falling, the weight of my body breaking the contact, saved my life.

Then there was the case of two men who were found dead from electric shock at the Sheffield baths. They were naked and in the water when they got hold of a rail which was charged through a fault in an electric cable passing through it. The voltage was 200 a.c., and it was supposed that they had been there for twenty minutes before being discovered. Another interesting case was that of two men who were killed in Liverpool in the early days of the electrifying of our trams. The voltage was 600 d.c. The men became entangled in some telephone wires that had fallen across the trolley wires after a snow storm. They were not killed outright, but were rolling about for nearly an hour and people were too frightened to go near them. They were killed by an intermittent shock and not by direct shock.

In conclusion, I would just like to say I may not be quite correct in my details as I have lost the cuttings from the papers which gave the stories of the events as they go back a number of years.

Liverpool, *August 5th.* CHAS. RETTIE.

Electricity Supply in France

Growth of water-power production

THE latest issue of the statistics relating to the generation and distribution of electricity published by the French Ministry of Public Works* is in an enlarged form and once again commences with data concerning hydro-electric developments. These figures were omitted from the returns published for the year 1933. On January 1st, 1935, the hydro-electric stations of France, of at least 1,000 kVA installed power, amounted to a total installed capacity of 3,156,945 kVA (compared with 2,900,775 kVA on January 1st, 1933, an increase of about 8.8 per cent. in two years), with available power as follows: In running order, 1,302,864 kW (compared with 1,240,473 kW); under construction, 141,940 kW (176,495 kW); projected, 3,060,037 kW (3,110,887 kW); apparently practicable but no concession yet sought, 1,307,645 kW (1,313,755 kW); total 5,834,726 kW, including provisional installations. In addition, there is 355,847 kVA installed in hydro-electric stations of less than 1,000 kVA, with an available power of 186,268 kW.

It should be noted that here and throughout these statistics "installed power" is the total of the kVA ratings on the name plates of generators in running order, including spare sets; this figure may be considerably greater than corresponds to the total boiler capacity in thermal stations or to the total kW that can be developed, except intermittently, in hydro-electric stations. In order to provide a definite basis of comparison, the "available power" of the works is taken as N/8,760 where N=the total kWh that it is technically possible to generate per annum (8,760 hours) by running as much plant as possible at every moment. Thus, in thermal stations the "available power" is the total kW capacity of the machines that can be operated simultaneously, and in hydro-electric stations it is the total kW corresponding to the mean flow and head determined over as long a period as possible.

Separate tables in the original statistics enumerate the maximum head, installed and available power, and nature of service for individual hydro-electric developments and prospects on different watercourses, with corresponding totals for districts. A supplementary table shows another 229,500 kVA (45,000 kW available power) to have been placed in service during 1935, bringing the total installed capacity up to 3,386,445 kVA and the available power to 1,347,864 kW, or 1,370,104 kW including provisional installations. A full list is given of the elevations and capacities of storages of at least 35.3 million cu. ft. useful capacity, equivalent to the ability to store not less than one million kWh.

The statistics relating to thermal power stations that supply public distribution networks show the type of fuel used and the kVA capacity installed, normally available and under construction in each. These particulars lead to a summary, the main entries in which, as regards stations burning solid fuels, are:

	Installed kVA.	kVA normally available.
Electrical industry (generation and distribution)	4,500,998	3,342,152
Colliery industry	1,114,510	746,305
Metallurgical industry	94,205	65,150
Others	104,400	63,790
Total	5,814,113	4,217,397

The increase in the main item, generation and distribution for general supply, amounts to about 535,000 kVA extra available power at January 1st, 1935, compared with January 1st, 1933. In addition, there is 894,405 kVA installed capacity (687,970 kVA normally available) in thermal power stations burning liquid or gaseous fuels, with or without some solid fuel, and 70,000 kVA is under construction.

The above figures specifically exclude works delivering to private networks not effecting public distribution. On the other hand, the following summary shows the installed capacity in thermal and water power stations having as their principal object the stated services, and the kWh generated in each case during the year 1934:

Main object.	Thermal stations.		Hydro-electric stations.	
	Installed kVA.	Million kWh in 1934.	Installed kVA.	Million kWh in 1934.
Distribution	2,787,915	2,012.4	1,078,511	2,296.3
Generation	2,036,664	2,327.0	1,337,348	2,720.8
Electro-chemistry or -metallurgy	9,000	1.2	578,802	1,452.5
Mining	1,467,520	2,179.1	53,333	155.4
Metallurgy	722,252	1,397.0	16,205	36.3
Others	74,205	60.7	257,463	533.8
Total	7,097,556	7,977.2	3,321,662	7,195.2

Thermal and water-power stations thus contributed in the ratio 52.5 :47.5 per cent. to a total production of 15,172.4 million kWh, of which 11,649 million kWh was delivered to distribution networks and the remainder utilised directly from the station bus-bars. Data concerning the fuel consumption of thermal stations in 1934 are to be included with the statistics for 1935; the returns for 1933 showed an average of 1.70 lb. coal per kWh, compared with 1.86 lb. in 1932.

The lengths of distribution lines in various categories were as follows in 1934:

Current and voltage.	Kilometres.	Miles (approx.).
D.C., not over 600 V	5,085	3,160
A.C., not over 150 V	152,526	94,776
A.C., 150–250 V	87,812	54,564
H.V., below 60 kV D.C. or 33 kV A.C.* ...	216,587	134,581
E.H.V., at least 60 kV D.C. or 33 kV A.C.* ...	16,366	10,169

* Between conductor and earth.

Out of a total of 9,466 million kWh distributed by these lines in 1934, about 6,706 million kWh was taken at high voltage and 2,760 million kWh by low-voltage power, lighting and domestic consumers. In towns of over 40,000 inhabitants the total distribution was 3,233 million kWh, about 1,814 million kWh at high voltage and 1,419 million kWh for low-voltage power, lighting and domestic uses. The relative importance of distribution networks in various categories is shown by the following summary:

Networks distributing per annum.	No. of Networks.	Total distribution in 1934. in million kWh.
Over 100 million kWh	31	5,613.1
50 to 100 million kWh	15	1,250.4
20 to 50 million kWh	46	1,487.2
10 to 20 million kWh	38	492.8
Less than 10 million kWh	1,653	622.8
Total	1,786	9,466.2

The number of consumers with no electrical distribution was further reduced to 2,635 (population 936,264) on January 1st, 1935, compared with 3,362 (population 1,230,996) on January 1st, 1934, and 4,437 (population 1,643,422) at the beginning of 1933.

During the period 1924-1930 the average consumption per inhabitant for the whole country rose continuously from 197 to 327 kWh per annum, a total increase of about 66 per cent. in six years. Then followed years of depression, but in 1934 the average consumption again rose to 309 kWh per inhabitant. These and other data for the period 1924-34 are shown by the following summary:

	1924.	1926.	1928.	1930.	1932.	1934.
Generation, 1,000-million kWh:						
Thermal stations	5.5	6.5	7.4	8.5	7.7	8.0
Hydro-electric	3.6	4.7	5.6	6.9	5.9	7.2
Per inhabitant, kWh:						
Generated + Net imports ...	231	284	326	379	337	373
Consumed	197	244	284	327	282	309

These figures relate only to stations which dispose of at least a part of their output through a distribution network. Of the total consumption from such stations in 1934 about 10,229 million kWh was at high voltage (traction 935, electro-chemistry and electro-metallurgy 2,188, and other uses 7,105 million kWh), and 2,760 million kWh at low voltage (969 million kWh for power and 1,791 million kWh for lighting and domestic appliances). The average total consumption of 309 kWh per inhabitant for 1934 includes 43 kWh for lighting. The total distribution in towns of over 40,000 population in 1934 was 3,233 million kWh (1,814 million kWh at high and 1,419 million kWh at low voltage), and the averages per inhabitant for the year were: High voltage 162 kWh; low voltage 127 kWh (41 kWh for power and 86 kWh for lighting and domestic uses); total, 289 kWh.

* "Statistique de la Production et de la Distribution de l'Energie Electrique en France pour l'année 1934." Pp. 73. Paris: Imprimerie Nationale.

International Congress for Women

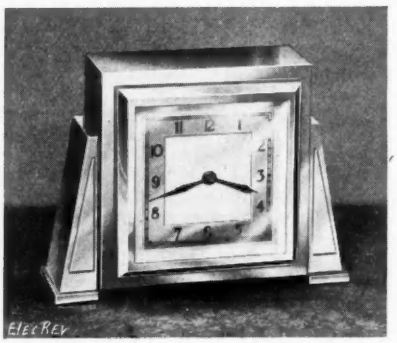
During the recent Congress of the International Federation of Business and Professional Women held in Paris representatives from twenty-four countries were present at a luncheon given in their honour by M. Ernest Mercier, of l'Union d'Electricité and visited the Centrale de Vitry-Sud power station. Among the representatives from Great Britain were Miss Caroline Haslett, chairman of the British Federation of the organisation and director of the Electrical Association for Women; Councillor Mrs. Messenger, of the Bungay Electricity Co.; and Mrs. Flack, of the G.E.C. and chairman of the E.A.W. Demonstrators' Circle. The Congress discussed the opportunities for work and the status of women in business and the professions.

New Apparatus and Devices

for Domestic, Cooking and Heating, Lighting, Power and Scientific Purposes

Mains-operated Clocks

Several additions have been made to the range of a.c. mains clocks sold by T.M.C.-HARWELL (SALES), LTD., Hollingsworth Works, Martell Road, West Dulwich, London, S.E.21. There is a new chromium model with a silver and cream dial (No. 89); No. 3572 has two pillars, the body being available in oak, walnut or mahogany, while No. 2594A is of grained oak without a separate dial. More orthodox shapes are Nos. 3567, 3571 and 3457, the last-named incorporating a Westminster chime. Walnut and inlaid rosewood are employed for No. 007, which has a square silver and cream dial and a chromium bezel. It measures 10 in. wide by 5¾ in. high by 2 in. deep. A white-enamelled electric wall clock for kitchen use has also been introduced.



The new "Temco" model 89 chromium clock

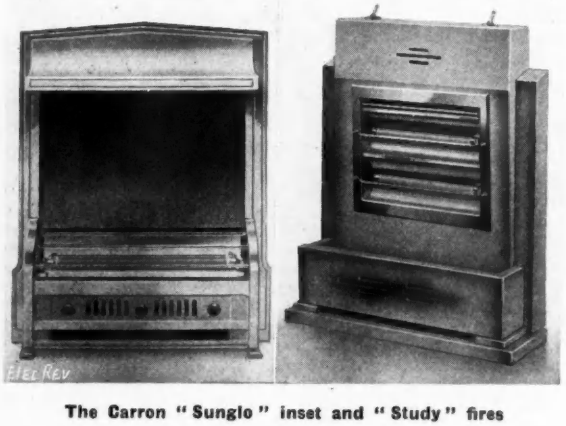
An Easy-fixing Shade Fitting

A new idea in lighting shade fittings is the "Easifix," a product of MESSRS. HAILWOOD & ACKROYD, LTD., Beacon Works, Morley, near Leeds. It is designed to avoid having to screw and unscrew the shade ring from the lampholder to detach the shade for cleaning. It is claimed that with the "Easifix" system, for use with which five designs of glass shades are available, the shade can be taken down and replaced in three seconds.

The "Hailware Easifix" shade fitting

Electric Fires

Four additional electric fires have recently been introduced by the CARRON COMPANY, Carron, Falkirk. They comprise a "Study" fire, which is a 2-kW model with a floodlight effect; a "Sunglo" inset fire; an illuminated model; and a cast-iron reflector type.



The Carron "Sunglo" inset and "Study" fires

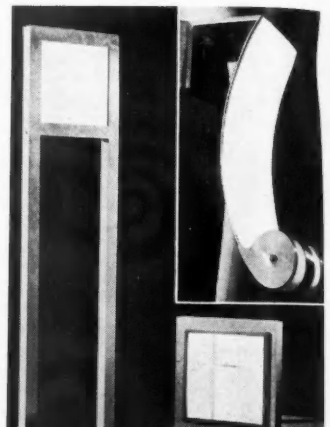
Following upon the success of the "Sunglo" as a portable fire it has been decided to adapt it for building-in, hence the introduction of the new model. All the essential features have been preserved, with the addition of a modern frame. The loading is 2½ kW.

Modern Lighting

The design of the lighting fittings as an integral part of an architectural and decorative scheme is a recent development in which MODERN LIGHTING, LTD., Grand Buildings, Trafalgar Square, London, W.C.2, is now specialising. A definite break away from tradition has been achieved, not only in the actual construction, but in a combination of materials employed. Bright colours also play an important part, and many of the designs are apparently influenced by the recent Chinese Art Exhibition.

One of this company's first models is a simple yet effective wall bracket, square in shape and just deep enough to hold tubular lamps that shine through panels of frosted glass. Some of these have been installed horizontally in the new reading room at the Building Centre, New Bond Street, and similar ceiling and pedestal models are available to match. Triangular fittings, which may also be installed horizontally, have a wave effect produced by coloured strips concealed within frosted glass.

Parchment is used to good effect in some cases and at the company's showrooms we were shown a unique pendant of polished copper, the S-shaped design of which served to conceal the lamps from view.



"Modern Lighting" fittings

Unusual Floor Standards

Two unusual designs of floor standards, both manufactured by the WALKER FENDER CO., LTD., Despatch Works, Sherborne Street, Ladywood, Birmingham, 16, have recently made an appearance.

One has a clock in the stem; either a synchronous electric type or a spring-driven model can be obtained. The other lamp has a table and an ash-tray built in. The ash-tray is so designed that it swivels round the stem of the lamp standard, while the table, which is fixed to the bottom end of the stem, doubled up to form a "U," is of bakelite Foster board and can be supplied in mahogany, walnut or ebony black. Both models have circular bases.

Two of the latest Walker Fender lamp standards

Price Rings. By "Manufacturer"

Points in favour of a much-abused system

IT is doubtful if any aspect of trade, in engineering or otherwise, arouses so much controversy and discussion as the question of the "price ring," which is the name given to a group of manufacturers of the same article who agree to sell at the same price in order to avoid destructive competition. Perhaps the best disinterested argument in favour of such agreements is the story told by Mark Twain in one of his travel books. The story concerns two rival coach companies who used to carry passengers over the same route. Bit by bit they cut their prices until both were carrying all the passengers absolutely free of charge. Finally one company started giving free meals and hotel accommodation, and, not very surprisingly, this last straw broke the other company's back.

The story ends there, but, taking it seriously for a moment, it may reasonably be supposed that the victorious company, having gained the monopoly, its prices would soar, and the poor passengers would have to pay through the nose. Quite obviously the sensible thing for these two companies to have done was to have come to a mutual agreement as to price, share the trade, and each make a reasonable profit. In this way both would have benefited from the start, and the absence of a complete monopoly would also have been of ultimate benefit to the passengers.

Such an agreement would have constituted a "price ring" in its most elementary form. Most opposers of the price-agreement system refuse to admit that the "trade ring" has any other effect than to fill the pockets of its members by means of inflated profits. "It's grossly unfair," one engineer said to me. "Half a dozen firms get together, stick on any price they like regardless of cost of manufacture, and then sit back and wait for the money to roll in. They know we've got to buy the stuff from one of them. The profit is safe, and they don't need to spend a cent on development work or improvements. Healthy competition," he added, "gives us fair prices which are really based on costs. In addition, the manufacturer is forced, in order to keep abreast of his rivals, to find new ideas and developments, and thus progress is hastened."

A Check on Profiteering

In theory, if we assume that all business men are entirely devoid of soul, it is certainly possible for a "ring" to place any price they like on an article. It is well known, for instance, that many patented articles are sold at fantastic prices because one firm has a complete monopoly.

Where agreements between several firms are concerned, however, practical considerations prevent an excessive profit from being made. If the margin between the cost and price becomes too great the fact is soon noticed by outside interests and a number of "non-ring" concerns arise, with disastrous results to the original manufacturers. The profit, then, for economic reasons, must be kept within reasonable limits.

So far as the question of progress and development is concerned, I may as well recount my personal experience in this direction. I was once a member of a firm which belonged to a price ring. For some reason or other the members had a disagreement and the ring broke up. As a result a fierce fight for business ensued, which had several bad effects. First of all, profits were cut down to a negligible figure. Next came a slash at the wages of the staff and workmen. They were told, more or less, of the position the firm was in, and were forced to accept the cuts. When even this was found to be insufficient the work itself was skimped. Materials were bought only at the lowest prices. Where there were tolerances the calculations were based on the top limit, materials were worked harder and chances were taken in the cause of economy. If the job passed the tests, well and good; if it did not—well, they couldn't afford to reject it, and it was scrambled through.

This sort of thing went on for several years, at the end of which period a further agreement was reached and a new ring formed. Obviously prices were exceptionally low during this period. What is even more significant is that the customers got very cheap and nasty jobs in return for their money. In addition, the employés of the firm were impoverished due to their reduced wages. It is not going too far to suppose that a similar state of things existed amongst the other firms, so that a considerable amount of domestic misery must have been caused by the breaking up of this particular ring.

In view of the keenness of the above "healthy competition," how is it to be expected that the firm could spend money on development work? In a scrambling hand-to-mouth existence such as I have described it is as much as a concern can do to keep its head above water, without investing money in projects which will not pay their way for perhaps several years. As a result, very little progress was made in this particular line during the non-ring period.

How the Customer Benefits

Contrast the above with a manufacturer who is a member of a ring. He is fully aware that his price and performance are the same as everyone else's. These being fixed, he has to find other means of making his proposition more attractive than that of his competitors, and this can only be done by giving his customers more for their money. Consequently, there is an all-round improvement in his manufactures. In an effort to beat his rivals he is forced to spend money on the development of new ideas, and progress is thus hastened. The customer admittedly pays more, but in return he is sure that the jobs he buys comply generously with the specification. Furthermore, the development work for which he is paying indirectly eventually comes back to him in the shape of general improvement.

A further advantage of the trade ring is that it puts a stop to the underhand methods used by certain buyers. We all know the "Dutch auctioneer" who gets half a dozen quotations for a job, hawks round the lowest till somebody quotes even lower, then hawks round *that* one, finally buying the job at a price which barely covers material and labour costs.

An American who came to this country a year or so ago went even further than this. He obtained quotations from several firms, including ours. One morning he rang us up and said that "X" had quoted 20 per cent. lower than we had, and what were we going to do about it? Well, "X" being members of the ring, we complained of their breach of rules. It turned out that they had quoted exactly the same price as ourselves, and that the American had simply invented his story. Such people are a menace to any industry, and any system which puts a brake on such practices is to be favoured.

Everyone admits, when brought to the point, that the manufacturer is entitled to a reasonable amount of profit on the goods he makes. It is one object of the trade ring to see that this *reasonable* profit is obtained; the manufacturer puts down capital and plant, furnishes expert guidance and takes a big risk, and is entitled to some measure of reward. Most people realise all this, but it is, nevertheless, only natural to choose the lowest available price, and until this quality of human nature changes the price ring will continue to be necessary.

New Books

Radio Receiving and Television Tubes. By J. A. MOYER and J. F. WOSTREL. (Third edition.) Pp. 635; figs. 487. London: McGraw Hill Publishing Co., Ltd. Price 24s.

This book, by well-known American authors, deals almost entirely with American practice and refers to and describes valves of American manufacture only. It is primarily a text-book for the designer and advanced worker rather than the amateur, although there is much of interest for the discerning reader. The purpose and mode of use of each type of valve is described in a clear manner, and, in particular, the section devoted to detectors attains a degree of lucidity much in advance of text-books generally. A suitable selection of illustrations and circuit diagrams is given throughout the book, and these are both numerous and good.

That more space is not devoted to television is disappointing, but, on the other hand, this portion of the book deals only with modern developments, and the iconoscope and electron gun are well treated. The few industrial applications described cover a wide and useful field, ranging from simple counting to radio-needle surgery with its many advantages. The latter subject makes interesting reading; it is a development with a promising future all too little known on this side of the Atlantic.

Chromium Plating. By E. S. RICHARDS. (Second edition.) Pp. 131; figs. 70. London: C. Griffin & Co. Price 4s.

Within the last few years rapid progress has taken place in the technique of plating articles with various metals in order to prevent corrosion and tarnishing effects. Among them chromium is now assuming a place of first-rate importance and has distinct advantages over other forms of plating.

The present volume is the second edition of this well-known text-book, the subject-matter of which proved to be of such great utility to the practical electro-plater, as it had the hall-

mark of the practical mind and one which was aware of the many difficulties and pitfalls which beset those engaged in the electroplating industry. The form of the first edition is preserved with the introduction of some new features, the principal of which deals with metal rectifiers, including brief descriptions of their properties and construction.

The author discusses in a highly practical manner the recent advances in barrel-polishing and barrel-plating operations which have taken place largely in the Birmingham area, where large plants have been installed. The method permits of the mass plating of small articles, such as nuts, bolts, and washers. A higher voltage is required for barrel plating in order to force the current through the perforated panels and the mass of moving parts. The revision has certainly enhanced the value of the work.

Shorter Notices

"Principles of Radio Engineering," by R. S. Glasgow. Pp. 520; figs. 344. London: McGraw Hill Publishing Co., Ltd. Price 24s.

"American Electricians' Handbook," by T. Croft (McGraw Hill Publishing Co., London; price 24s.). The fourth edition of this useful reference book for practical electrical workers has been completely revised and brought into accordance with the 1935 edition of the National Electric Code.

"Proceedings of the International Telephone Consultative Committee." (Plenary meeting in Budapest from September 3rd to 10th, 1934.) (English edition.) Pp. 660; figs. London: International Standard Electric Corporation. Price 25s. net.

"The Cathode Ray Tube at Work," by J. F. Rider. Pp. 333; figs. Manchester: Holiday & Hemmerdinger. Price 10s. 6d.

"Principles of Electric and Magnetic Measurements," by P. Vigoureux and C. E. Webb. Pp. 392; figs. London: Blackie & Son, Ltd. Price 20s. net.

A sixth edition of the first volume of "Modern Radio Communication" by J. H. Reyner (London: Sir Isaac Pitman & Sons. Pp. 330; figs. 157. Price 5s.), of which the fifth was printed only last year, has just been published. The work, which has been thoroughly revised and brought up to date, covers the preliminary and intermediate grades of the City and Guilds of London Institute in this subject, and provides a thorough ground-work in the theory of radio communication.

The German Electrical Industry

THE striking revival in the German electrical industry in 1934, when the index production rose from 38 to 58 per cent. of capacity reckoned in working hours, was continued in 1935. A Department of Overseas Trade report on economic conditions (Stationery Office, price 5s.) prepared by Mr. E. C. Donaldson Rawlins, commercial counsellor to H.M. Embassy in Berlin, states that production throughout the industry as a whole again improved by about 10 per cent. in 1935, mainly on account of better conditions in the home market.

Increased production

The additional investment in production plant, especially public contracts for the creation of work and orders placed by the military authorities, was stated to have given considerable support to sales of electrical plant and products of all kinds. On the other hand, the turnover in domestic goods was only on a level with sales in 1934 in spite of the growing popularity of electricity in the home, where the number of electric stoves installed increased from 232,000 in 1934 to 380,000 in 1935 and that of electric water-heaters from 90,000 to 110,000. Compared with 1932, the number of workers employed in Germany in the electrical manufacturing industry in 1934 at 87,324 was lower by 48.5 per cent., while the total in the electric power industry (13,481) shows a decrease of 18.7 per cent.

Electrical Exports and Imports

Exports of electrical plant amounted to 14,000 tons valued at Rm.29.6 million in 1935, compared with 11,500 tons worth Rm.30.2 million in 1934. Orders from the U.S.S.R. fell from Rm.2.3 million in 1934 to Rm.185,000 last year. Foreign sales of other electrical products have also improved. The volume rose from 51,000 tons in 1934 to 63,000 tons last year, and the value from Rm.169 million to Rm.177 million. Exports of cable increased from 18,000 tons in 1934 to 25,000 tons in 1935, and of insulated wire from 10,000 tons to 14,000 tons, but average prices were much lower.

Imports of electrical machinery declined from 1,660 metric tons valued at Rm.3.8 million to 841 tons valued at Rm.2.2 million. Purchases of other foreign electrical products amounted to 2,717 tons (Rm. 17.4 million), as compared with 3,307 tons (Rm. 22.0 million). Anglo-German trade was much facilitated by the Commercial Payments Agreement reached on November 1st, 1935.

According to investigations made by the Business Research Institute, production and sales of electric lamps amounted to 61 millions in 1932-3, as against 99 millions in the boom period 1928-9. During 1933-4 about 68 million lamps were manufactured, a figure which was probably surpassed in 1934-5. Evidence of this is furnished by tax returns regarding the sale of German and imported lamps, which show that 63 million were sold in 1933-4 and 76 million in 1934-5, the largest turnover in the past ten years. The bulk of the increase was due to sales of German lamps. Apart from the high demand in connection with public works, the use of electric lamps in the household has risen, partly under the influence of a recent reduction in prices of 14 per cent. In 1933 some 43 million lamps were exported; in 1934, 41 million; and in 1935, 46 million; but prices have dropped, the total value being (in million Rm.) 10.7, 9.4, and 9.5 in the respective years.

Radio Set-back

After two years of production on a high level, the German radio industry suffered a decided set-back in the second half of 1935. During the first four months of the year output was greater than in any other year, but a serious curtailment then began and by November production had fallen to 143,000 sets, as against 320,000 sets in November, 1934, and was still in excess of current sales. Total sales dropped from 1,225,000 sets in 1934 to 810,000 sets in 1935. These figures include 526,000 and 290,000 units respectively of the so-called "People's Set," a standardised type sold in 1933 at a uniform price.

It is calculated that 185,000 more receiving sets had been made in the last two years than were sold, apart from the stocks previously in hand. Stocks held by manufacturers at the end of the radio year (July, 1935) were estimated at 400,000 sets, to which must be added from 100,000 to 200,000 in possession of dealers. These figures for stocks were stated to be the highest on record. Great efforts were made to force exports in the latter part of 1935, and 40,000 sets were sold abroad in October and November, approximately half of the previous year's turnover.

Total exports of radio apparatus fell from Rm.44 million in 1932 to Rm.29 million in 1933, Rm.27 million in 1934 and Rm.26.6 million in 1935. Formerly, some German firms sold 50 per cent. of their output abroad; to-day the export trade is reported to account for only 7 per cent. to 8 per cent. of total radio sales.

Television research has included the installation of a transportable transmitter on the Brocken at an altitude of 3,500 ft., from which successful broadcasts were made up to 100 kW. The Postal Authorities reported in December, 1935, that television still presented numerous problems and that a great deal of work was essential for the development of present plant. The television transmitter at Witzleben (Berlin) was destroyed by fire in August, 1935; a new plant was opened in December, 1935, and the programmes made accessible to the public at eight post offices. An experimental television telephone service was opened between Berlin and Leipzig in March last.

Generation of Electricity

The production of electricity of 122 public power stations, representing over 90 per cent. of Germany's total output, amounted to 17,900 million kWh in 1935, as against 15,500 million kWh in 1934. The proportion furnished by water power rose from 15 per cent. to 17 per cent. Including the output of firms with their own generating plant, the total power supply in 1935 was estimated at between 34,000 and 35,000 million kWh, compared with 30,000 million kWh in 1934 and 26,000 million kWh in 1933. The production of the Saar was about 400 million kWh. About 70 per cent. of the whole supply is used by industrial concerns, 20 per cent. by small consumers and 10 per cent. by railways, tramways and municipal authorities.

In December, 1935, a Power Law was passed by the German Government, providing for the control and reorganisation of the industry where necessary by the Minister for Economic Affairs. The flotation of new power companies, reconstruction, extension and limitation or cessation of production by existing plants must be reported and is subject to Government sanction. The powers of local authorities are restricted to prevent them from interfering with developments of general interest to the Reich. A unification and reduction of tariffs is also provided for and the Minister may in this connection prohibit power production by any individual enterprise. In the interests of national military security the Minister may make special conditions applicable to individual companies regarding the maintenance or construction of plants and the sale of power. Imports of electricity are also made subject to the control and sanction of the Minister.

Business and Industrial Notes

The Week's News. Showrooms and Exhibitions. New Installations. Overseas Trade. Publicity Material. Trade Announcements. Prices of Materials. Liquidations and Bankruptcies.

The Empire Exhibition at Johannesburg

Messrs. R. A. Lister & Co., Ltd., who are supplying the thirty auto-trucks which are to convey visitors round the extensive grounds of the Empire Exhibition in Johannesburg this autumn, are to have a comprehensive display of their products on the stands of their distributors in South Africa, Messrs. Stewarts & Lloyds of South Africa, Ltd. Their display includes a representative selection of their petrol and Diesel engines, lighting plants, sheep-shearing machinery, auto-trucks and cream-separators. The actual exhibits are as follows: 5-b.p. single-cylinder Diesel engine; 16-h.p. twin-cylinder Diesel engine; 1-kW and 750-W petrol-driven electric generating plants; 1.5-kW Diesel-driven electric generating plant; R.H.C.-type petrol-driven, 3-wheeled elevating auto-truck with stillage; portable 4-set sheep-shearing plant; and cream-separators. On the walls of the stands will be large-scale coloured sectional illustrations of engines and cream-separators. All the engines shown, both independently and as driving units for the electric plants, are of the 4-stroke, vertical type, and we are informed that most of the industrial machinery from Great Britain on view in the Exhibition, and requiring from 1½ to 20 h.p., will be driven by Lister engines.

Modernising Olympia

Olympia, Kensington, is being brought up to date at a cost of £250,000. Substantial alterations are being carried out in the Grand, the National and the Empire Halls, and much of the work is nearing completion, while additional buildings on sites secured by demolitions will be ready in the autumn. The Addison Road entrance and the adjoining offices are being replaced by a vestibule, four times the size of the old one, reaching from the pavement to the hall and having a covered way to the railway station. Another enclosed walk will give shelter from Hammersmith Road into Olympia. The Empire Hall is being remodelled in order to provide the fullest space for all types of exhibitions. The important internal changes here involve the removal of the central stairways, their place being taken by escalators to convey 4,000 people an hour to all the floors, while six large lifts are also available for the public. The alterations in the Empire Hall provide a light well three times the present size, and there is to be a glass roof of the most up-to-date type. The reconstruction of Olympia provides over 500,000 sq. ft. for exhibition purposes. Immediately adjoining the halls will be a six-storey service garage to hold 650 cars. The whole of the interior of Olympia has been cleaned and decorated, twenty-five tons of cream and green paint being used. Other innovations include lounges, rest rooms, hairdressing saloon, dressing and bath rooms, snack bar, refreshment department and new offices for the use of exhibition organisers and exhibitors. The consulting electrical engineers are Messrs. Albion T. Snell & Partners.

Municipal Trading at Watford

At a recent meeting of the Watford Town Council the question of the sale of electrical fittings and apparatus at the proposed new showrooms was considered. It was decided to adopt a scheme similar to that in operation at Bath, subject to agreement with electrical contractors in the town, and that subject to such scheme the Corporation should sell electrical fittings at the showrooms. Under the scheme the Corporation will co-operate only with approved electrical contractors and retailers. It will retain 10 per cent. of the list price of electrical apparatus sold at the showrooms through an electrical contractor, the balance of the recognised trade discount being allowed to the approved contractor. If a contractor obtains the signature of a consumer for the hire of any apparatus he will be allowed a scheduled commission, and subject to the approval of the Corporation, he may carry out the wiring work at stated rates. A contractor will also obtain the order to carry out installation work on hire-purchase terms at scheduled rates, providing he obtains the signature and the order from the customer concerned. All orders that are booked by the Corporation for scheduled installation work will be given out to approved contractors on a rota, at specified rates.

A Hotpoint circulator display at the showrooms of the Nottingham Corporation Electricity Department

The Barnet Hospital Carnival

A carnival was held on August Bank Holiday at Barnet in aid of the Victoria Cottage Hospital, and in the decorated trade cycle class the North Metropolitan Electric Power Supply Co. was awarded first prize for its entry. Our picture shows the effective lay-out of this display, which was in the charge of a young man in the guise of the E.D.A. "I'm Electric" figure.

The "Northmet" entry at the Barnet Hospital Carnival

A Circulator Display at Nottingham

The accompanying illustration shows a recent window display at the showrooms of the Nottingham Corporation Electricity Department, dealing with Hotpoint circulators. The display was arranged in conjunction with Messrs. John Player & Sons, and is an interesting example of co-operation between supply authority, manufacturer and an outside local industry.

Social Events

Santon, Ltd., is well known in the electric water-heating industry, but its activities in the world of sport are not so generally known. Its successes during the present year include the winning of the W. J. Wall cup by the rugby football team, and the Pauncefort-Munday cup and the Dr. Bowker cup by the air rifle shooting team, while the cricket and table tennis teams have been well placed in their respective leagues. The outstanding individual success has been achieved by Miss Shelagh L. Browning, one of the company's lady demonstrators, who has a long list of swimming successes to her credit covering the years 1933-35. She is the holder of a number of championships, and her latest achievement is winning for the third year in succession the English national long-distance championship against all comers. This championship was swum over five miles of the Thames from Kew to Putney. We publish a portrait in our Personal Column to-day showing Miss Browning with the cup which she has won for the last-mentioned event.

Orders Recently Booked

International Combustion, Ltd., has received an order for two "Lopulco" tri-drum boilers with water-cooled furnaces

for the City of Bloemfontein power station. Each boiler will have a normal evaporation of 60,000 lb. per hr. and a maximum evaporation of 75,000 lb. per hr., and each will be fired by an Underfeed class "L" stoker. The contract also covers "Usco" airheaters, draught plant, ash-handling plant and stacks. An order has also been received for a complete ash-handling plant for Hull Corporation. It will be of the hydraulic sluice type handling ashes from the two new boilers, and the trough will be in concrete, having chrome alloy liners. The contract includes air-sealing doors, chutes, pumps, motors, piping, valves, and water-receiving chamber over the storage bunker. Another order for ash-handling plant has been received from the London Power Co. for installation at its Deptford West power station.

Messrs. Clarke, Chapman & Co., Ltd., have obtained a contract from the Edinburgh Corporation for boiler plant in connection with extensions to the Portobello power station. This important contract comprises two water tube boilers complete with superheaters, mechanical stokers, economisers, air heaters, mechanical draught plant and dust collectors. The boiler portion of the contract consists of two Clarke Chapman tri-drum water tube boilers each capable of evaporating 120,000 lb. of water per hr. The working pressure is 310 lb. per square in. and the steam is superheated to a final temperature of 750 deg. F. The approximate value of this contract is £80,000.

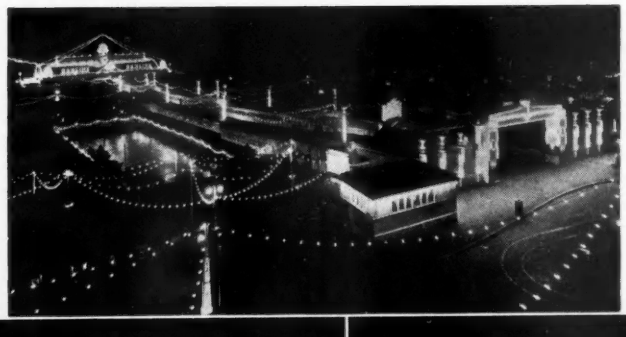
New Municipal Showrooms

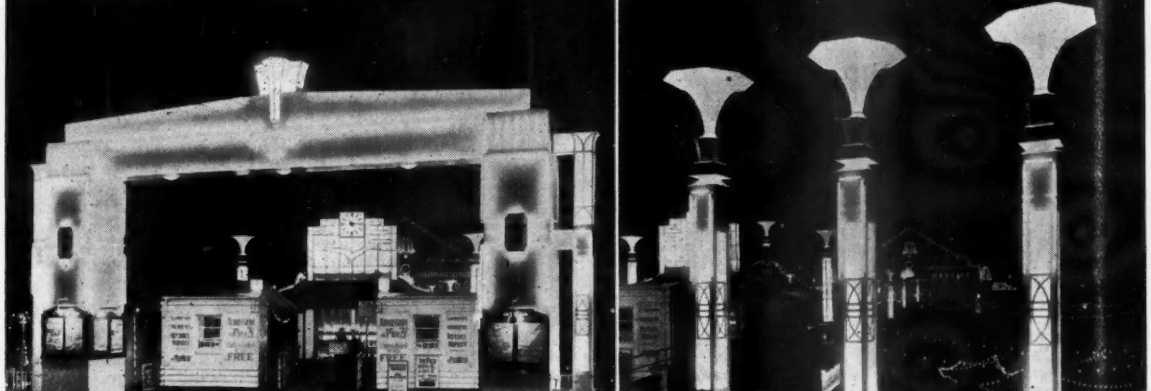
The Bradford Corporation Electricity Department has opened a new showroom for domestic appliances at Tong Street, Dudley Hill. A substantial reduction in hire charges for electric cookers is announced.

At a meeting of the Chichester City Council on July 29th plans and estimates prepared by the city surveyor for the erection of showrooms for the Electricity Department were considered. The special Electricity Sub-Committee recommended that the Council should purchase premises in East Street and Halsted's Yard and the premises adjoining for £10,000. The Council decided, however, to ask the owner the lowest price he would be prepared to accept for the property, and the surveyor was instructed to prepare sketch plans showing how the present Council offices in Grey Friars could be used to meet the Electricity Department's requirements, and of the alterations necessary for the East Street site, with estimates in each case.

Southend Illuminations

The illumination of the pier entrance, Southend, which has just been carried out by Capt. J. C. Johnson, the pier master responsible for the lighting of the whole of the pier and the foreshore, has been executed on very ambitious lines. New wiring has been installed, consisting of tough-rubber sheathed and armoured cables, with neatly arranged control boxes dealing with various sections of the pier. All this wiring has been carried out to I.E.E. Regulations, the installation work being supervised by Mr. E. G. Goble, chief engineer. The lighting of the entrance is extremely picturesque; the entrance itself is illuminated by several hundreds of Osram architectural lamps in white, blue and amber, with a surmounted ornamental unit constructed of flashed opal glassware equipped with Osram lamps. The side features have also been specially designed and manufactured by the G.E.C., and these again consist of ornamental pylons glazed with flashed opal. A very pleasing effect at the entrance is the trumpet-shaped pylons which are mounted on specially designed columns glazed with opal glassware. Similar trumpet-shaped units are installed along the pier itself from the main entrance to the dance hall. The illuminations also include numerous illuminated set pieces, both of the still and animated kind. The various serpent settings, a replica of the *Queen Mary*, a yacht in full sail and scintillating peacock and rising-sun formations introduce a number of extremely ornamental colour-lighting features.





The Southend Illuminations showing (top) a general view of the pier, (left) the pier entrance illuminated by Osram architectural lamps and G.E.C. ornamental centre piece, and (right) the G.E.C. decorative pylons at the entrance and along the pier

Salford Accessories

With reference to the paragraph under the above heading on page 184 of last week's issue, we are informed that the earth-leakage trips, bell transformers and air thermostats described therein, are marketed by The General Electric Co., Ltd., Magnet House, Kingsway, London, W.C.2.

Public Lighting Engineers' Conference

The following companies will have stands at the exhibition held in connection with the Association of Public Lighting Engineers' Conference at Cheltenham from September 7th to 10th :—

Automatic Electric Co., Ltd.
British, Foreign & Colonial Automatic Light Controlling Co., Ltd.
British Thomson-Houston Co., Ltd.
Curtis Lighting Co.
Edison Swan Electric Co., Ltd.
Electric Street Lighting Apparatus Co.
Engineering & Lighting Equipment Co., Ltd.
Foster & Pullen, Ltd.
General Electric Co., Ltd.
Gowshall, Ltd., & Bromford Tube
Holophane, Ltd.
Horstmann Gear Co., Ltd.
James Keith & Blackman Co., Ltd.
C. H. Kempton & Co., Ltd.
W. Parkinson & Co.
Patent Safety Ladder Co.
Philips Lamps, Ltd.
Radiovisor Parent, Ltd.
Revo Electric Co., Ltd.
Siemens Electric Lamps & Supplies, Ltd.
Simplex Electric Co., Ltd.
Walter Slingsby & Co., Ltd.
William Sugg Co., Ltd.
Venner Time Switches, Ltd.
Weston Electrical Instrument Co., Ltd.

The Building Exhibition

Earl Stanhope, K.G., First Commissioner of Works, will formally open the twentieth (biennial) Building Exhibition at Olympia on September 16th.

Shop-window Lighting Improvements

A good example of the use of the new Holophane "Controlens" prismatic lens plate system for shop-window lighting has just been completed by Messrs. A. J. Record at the dress stores of Messrs. Courtneys at Exeter. Actually, the plates form a false ceiling of panelled glass, the lamp and reflectors being placed above. The plates refract the light rays from the top reflector equipment and redirect them into an intense beam which illuminates the display. By adjusting the focus and position of the lamp and reflector with regard to the plate varied angles and intensity of the light can be arranged, and it is claimed that the system increases the bare lamp candle-power over ten times. Holophane, Ltd., tells us that the particular advantage possessed by this type of illumination is that it

The new **Holophane "Controlens" prismatic lens plate system of shop-window lighting has recently been installed at the Exeter dress stores of Messrs. Courtneys**

may be successfully combined with a colour-lighting installation in the rear of the window, throwing a strong light on the articles in the foreground without interfering with the colour effects behind. In Messrs. Courtneys' windows, type "755" plates have been employed with "F.9580" reflectors and 100-W lamps. Chromium-plated "Hedralite" panels (type "H.C.412B") incorporating 60-W lamps have been installed over the entrances.

Prices of Materials

The following prices are only general, and they may vary according to quantities and other circumstances:—

CHEMICALS, ETC.	Price. August 12th.	Fortnight's Inc. or Dec.
[a] Acid, Oxalic ... ... per cwt.	50s.	—
[a] Ammoniac, Sal ... ... per ton	£36	—
[a] Ammonia, Muriate (large crystal) ... „	£18 10s.	—
[a] Borax ... ... „	£17	—
[a] Copper, Sulphate ... ... „	£15 10s.	—
[a] Potash, Chlorate ... ... per lb.	3¾d. to 4¼d.	—
[a] „ Perchlorate ... ... „	6d.	—
[a] Shellac ... ... per cwt.	£4 18s.	—
[a] Sulphur Commercial ... ... per ton	£11	—
[a] „ Roll ... ... „	£11	—
[a] Soda Chlorate ... ... per lb.	3¼d. to 3¾d.	—
[a] „ Crystals ... ... per ton	£5 to £5 5s.	—
[a] Sodium Bichromate, casks ... ... per lb.	4d. nett.	—
METALS, ETC.		
[b] Aluminium, Ingots ... ... per ton	£100 to £105	—
[b] „ Wire ... ... per lb.	1/1 to 1/9	—
[b] „ Sheet and Foil ... ... „	1/3 to 2/9	—
[b] Babbitts Metal and Anti-friction Metals—		
Grade I ... ... per ton net	£172	£3 dec.
Grade II ... ... „	£120	£2 dec.
Grade III ... ... „	£66	£1 dec.
[c] Brass (rolled metal 2" to 12" basis) per lb.	7½d.	—
[c] „ Tubes (solid drawn) ... ... „	9½d. to 10d.	—
[c] „ Wire, basis ... ... „	7½d.	—
[c] Copper Tubes (solid-drawn)... ... „	10½d.	—
[c] „ Bars (best selected)... ... per ton	£70	—
[c] „ Sheet... ... ... „		
[c] „ Rod ... ... „		
[d] „ (Electrolytic) Bars ... ... „	£43	15s. inc.
[d] „ „ Wire Rods ... ... „	£48 10s.	15s. inc.
[d] „ „ H.C. Wire ... per lb.	7½d.	¼d. inc.
[f] Bonite Rod ... ... „	1/6 to 2/- plus	—
[f] „ Sheet ... ... „	1/3 to 1/6 10%	—
[a] German Silver Wire ... ... „	2/5	—
[h] Gutta-percha, fine ... ... „	nom.	—
[h] India-rubber, Para-fine ... ... „	10½d.	½d. inc.
[i] Iron, Pig (Cleveland, No. 3) ... per ton	67/6	—
[i] „ Wire galv. No. 1, P.O. Qual.... „	£20	—
[g] Lead, English Pig ... ... „	£18 15s.	5s. inc.
[g] Mercury ... ... per bot.	£11 15s. to £12 5s.	5s. 6d. inc.
[e] Mica (in original cases) small ... per lb.	9d. to 1/6	—
[e] „ „ „ medium ... „	5/- to 10/-	—
[e] „ „ „ large ... „	10/6 to 17/6 up	—
[p] Phosphor Bronze, plain castings ... „	1/1	—
[p] „ „ drawn bars & rods „	11½d.	—
[p] „ „ rolled strip & sheet „	11½d.	—
[p] „ „ wire ... ... „	1/0½d.	—
[o] Platinum ... ... per oz.	£8 10s.	10s. inc.
[d] Silicium Bronze Wire ... ... per lb.	8 5/8d.	⅛d. inc.
[g] Spelter... ... ... per ton	£13 7s .6d.	12s. 6d. dec.
[r] Steel, Magnet, in bars ... ... per lb.	7½d.	—
[g] Tin, Block (English) ... ... per ton	£185 5s.	£5 15s. inc.
[a] „ Wire, Nos. 1 to 16 ... ... per lb.	3/8	—

Quotations supplied by:—

[a] G. Boor & Co.
[b] The British Aluminium Co., Ltd.
[c] Thos. Bolton & Sons, Ltd.
[d] Frederick Smith & Co.
[e] F. Wiggins & Sons.
India Rubber, Gutta Percha and Telegraph Works Co., Ltd.
[f] Henry Gardner & Co., Ltd.
[g] Edward Till & Co.
[h] Bolling & Lowe.
[i] P. Ormiston & Sons.
[o] Johnson Matthey & Co.
[p] C. Clifford & Sons, Ltd.
[r] W. F. Dennis & Co.

The above table is published here fortnightly. In alternate issues, in which it does not appear, the latest prices of copper, silicium bronze wire, lead, rubber, tin and spelter, up to the time of going to press, are given in our "Business Notes" under the same heading.

New Catalogues and Lists

General Electric Co., Ltd., Magnet House, Kingsway, London, W.C.2.—Two new illustrated art catalogues have been prepared dealing with miniature measuring instruments and industrial measuring instruments.

Kandem Motors, Ltd., 769, Fulham Road, Fulham, S.W.6.—A leaflet describing "Kandem" a.c. high-torque squirrel-cage motors.

Foster Instrument Co., Ltd., Letchworth.—A booklet (90 pages) dealing with thermo-electric pyrometers: a large part is devoted to technical notes on the theory, development and use of pyrometers, with information of a practical nature.

British Insulated Cables, Ltd., Prescot.—Cadmium copper for overhead lines is the subject of a new leaflet.

G. Ellison, Ltd., Perry Bar, Birmingham, 20.—A description of 11,000-V, oil-filled vertical isolating truck switchgear.

Bankruptcy Proceedings

J. R. Scattergood, 84, Uxbridge Street, Burton-on-Trent, Staffs, lately carrying on business at 142, Waterloo Street, Burton-on-Trent, radio dealer.—The receiving order herein was made on the debtor's own petition recently, and, according to the statement of affairs returned, there are unsecured liabilities of £963 and net assets of £8, leaving a deficiency of £955. It appears that when debtor commenced trading in Waterloo Street, Burton-on-Trent, as a radio dealer he had a capital of £100. The turnover was approximately £24 a week, but debtor had sustained heavy losses through bad debts and on amplification apparatus supplied for football matches, &c. In 1934 debtor made an arrangement with his creditors, and eventually closed the business. He has kept only a cash book.

G. W. Mitchell (described in the receiving order as G. Mitchell), 6, Connaught Terrace, Hove, electrical engineer.—This debtor attended at the Court House, Church Street, Brighton, on August 5th for his public examination, when it was reported that the unsecured liabilities totalled £887 with assets of £2, leaving a deficiency of £885. During the year ended September, 1933, the debtor estimated his turnover at £2,500, but early in 1933 the business had begun to decline owing to trade depression. Later he transferred the business to 19, Stirling Place, Hove, and eventually back to 6, Connaught Terrace, Hove. The examination was adjourned for closing.

C. S. Berridge, 83, St. John's Street, Bridlington, formerly carrying on business at the same address as an electrical contractor.—The first meeting of creditors herein was held at the Official Receiver's Office, Bank Chambers, Scarborough, on August 5th. The statement of affairs presented showed ranking liabilities of £175, with net assets of £17, or a deficiency of £158. Debtor stated that he realised his position in February this year, and attributed his failure to the after-effects of an accident in 1929, which incapacitated him for about six or seven months in 1934. The case, being a summary one, was left in the hands of the Official Receiver as trustee.

C. W. Prosser, trading as Prosser Brothers, 81, Woodside Street, Cinderford, Glos, electrical engineer.—The first meeting of creditors in this matter was held on August 5th at the County Court Offices, Commercial Road, Gloucester, when the case, being a summary one, was left in the hands of the Official Receiver as trustee. The statement of affairs filed showed ranking liabilities of £245, with net assets of £29 and a deficiency of £216. Debtor attributed his failure to ill-health, lack of capital, keen competition and local depression.

C. Armstrong-Lamb, 8, Clarendon Place, Hyde, Cheshire, electrician.—The public examination herein was held at the Town Hall, Ashton-under-Lyne, recently. According to the statement of affairs submitted there were assets of £110 with a deficiency of £630. The failure was attributed to insufficient turnover, ill-health, and losses on a housing contract in 1933 34 and under an assisted wiring scheme. The examination was adjourned.

H. Holiday, 4, Highfield Place, Morley, Yorks, electrician.—The first meeting of creditors herein took place at the Official Receiver's Office, Hallfield Chambers, 71, Manningham Lane, Bradford, on August 5th, when the case, being a summary one, was left in the hands of the Official Receiver as trustee. The statement of affairs presented disclosed gross liabilities

of £187 and no assets. Debtor attributed his failure to lack of capital.

Midland Electrical Installations (a firm) (other than S. Hinchliffe), electrical engineers, 443, Meadow Lane, Nottingham.—Receiving order dated May 6th, 1936 (so far as the same relates to H. Salmon, a partner), rescinded on July 23rd, 1936, on the grounds that debts and liabilities contracted when under twenty-one years of age.

R. Mason, radio and electrical engineer, Crown Square, Kirbymoorside.—Last day for receiving proofs for dividend August 19th. Trustee, Mr. C. L. Townsend, 80, High Street, Stockton-on-Tees, Official Receiver.

T. A. J. Edmunds (Essanee Radio & Electrical), 5, Lena Gardens, Hammersmith, W.5.—Trustee, Mr. E. Parke, Bankruptcy Buildings, Carey Street, W.C., Senior Official Receiver, released June 19th.

F. E. Lansdown, radio and electrical engineer, 68a, High Street, Winsford, Ches.—Trustee, Mr. F. C. Ormrod, 12, Lonsdale Street, Stoke-on-Trent, Official Receiver, released July 23rd.

S. Hancock (S. Hancock & Co.), electrical engineer, Clyde Street, Holt Town, Manchester.—Trustee, Mr. F. H. Langmaid, Byrom Street, Manchester, Official Receiver, released July 27th.

N. Ellis (Oxenhope Radio Stores), wireless dealer, Station Road, Oxenhope, and 20, New Road, Denholme.—First and final dividend of 1s. 10½d. in the £, payable August 14th at 71, Manningham Lane, Bradford.

R. J. Heath (Whitchurch Radio Service), 3, Brownlow Street, Whitchurch.—Trustee, Mr. F. E. Bendall, 3, Warwick Passage, Corporation Street, Birmingham, released July 14th.

C. J. Mount, electrical contractor, "White House," East Acton Lane, W.3.—Application for discharge to be heard on September 28th at the Court House, Brentford.

R. H. Hermann, radio dealer and engineer, "Kinnoull," Havant Road, East Cosham, Hants.—Public examination October 5th at the Court House, Portsmouth.

P. T. Bradley, radio engineer, 1, The Arcade, and 10, Church Lane, Stafford.—Receiving order made July 27th on debtor's own petition. Public examination September 23rd at the Shire Hall, Stafford.

J. Newton (Gateshead Electrical & Radio Service), 23, Whitehall Road, Gateshead.—Last day for receiving proofs for dividend August 26th. Trustee, Mr. P. J. McLellan, 81, St. Mary's Place, Newcastle-upon-Tyne, Official Receiver.

W. C. Bryant, electrical and wireless engineer, 13, Rodbourne Road, Swindon.—First and final dividend of 2s. 8d. in the £, payable August 18th at 26, Baldwin Street, Bristol.

Company Liquidations

Indo-European Telegraph Co., Ltd.—Meeting September 9th at Electra House, Victoria Embankment, W.C., to receive an account of the winding-up by the liquidator, Mr. A. R. Smith.

Cabaret Electric Co., Ltd.—Particulars of claims by August 25th to the liquidator, Mr. W. A. J. Osborne, Balfour House, Finsbury Pavement, E.C.

Gilberts Electrical, Ltd.—Meeting September 9th at Balfour House, Finsbury Pavement, E.C., to receive an account of the winding up by the liquidator, Mr. W. A. J. Osborne.

Private Arrangements

E. L. Gough, trading as Gough & Co., 77, Pershore Street, Birmingham, radio and electrical factors.—A meeting of the creditors herein was held recently, when it was reported that the debtor, Miss E. L. Gough, conducted the business in partnership with her brother. The latter was in hospital and unable to attend to the business. Debtor and her brother purchased the business in 1935 for £500. In April, 1936, a limited company was formed, and an agreement was entered into whereby the company took over all the assets of the partnership business, but did not undertake to pay the liabilities. From time to time Miss Gough advanced money to the company and to the partnership business. She had drawn £75 from the two businesses. It was resolved that a deed of composition should be executed in favour of Mr. G. R. Griffin, as trustee, to secure a composition of 15s. in the £, payable as to 5s. within one month, 5s. on September 30th and 5s. on December 30th, 1936. A committee of inspection was appointed consisting of Mr. F. E. Bendall (Messrs. Poppleton and Appleby), representing creditors, Mr. A. Cripwell, representing creditors, and Mr. Carter (Three Star Accumulators).

H. Bailey, electrical contractor and radio dealer, 54, Hamil Road, Burslem.—At the recent meeting of creditors in this matter a statement of affairs as at July 25th was submitted, which showed liabilities of £619, all due to the trade. The net assets were £197, leaving a deficiency of £422, subject to the costs of realisation. The debtor attributed his present position to lack of capital and endeavouring to finance his own hire-purchase undertakings. In order to protect the assets a deed of assignment had already been executed in favour of Mr. J. Paterson Brodie, of Burslem, as trustee, and the creditors decided to confirm the deed. A committtee of inspection was also appointed.

S. F. Drew, 2, Carmel Street, Abertillery, electrical and radio dealer.—The creditors interested herein were called together recently when it was reported that the liabilities amounted to £445 and there were assets of £19, with a deficiency of £426. The creditors decided that the debtor should be given seven days to come forward with a cash composition of 10s. in the £, failing which the matter should be dealt with in bankruptcy.

Dissolution of Partnership

Cable & Smith, radio and electrical engineers, &c., 171, Fog Lane, Didsbury, Manchester, and 244, Stockport Road, Cheadle Heath.—Messrs. H. T. Cable, F. Smith and J. A. Dawe have dissolved partnership.

Electricity Supply

Lighting, Domestic, Power

Barrow-in-Furness.—EXTENSIONS.—At a cost of £1,775 the Electricity Committee is to provide a supply to Bouth, Colton and Oxempark.

Bexley.—LOAD INCREASE.—Connections to the mains increased by 7,782 kW to 42,114 kW during the past year, according to the annual report of the electrical engineer. Heating, cooking, &c., accounted for 5,922 kW of the increase and 30,676 kW of the total. In addition, the street-lighting load was appreciably augmented (from 116 to 290 kW). Sales of energy to private consumers (excluding traction) amounted to 15,047,866 kWh, an increase of 32 per cent., and the number of consumers rose by 3,616 to 24,296.

Bishop Auckland.—SUB-STATION.—The North-Eastern Electric Supply Co., Ltd., is to erect a sub-station at Toronto, Bishop Auckland, to supply electricity to new houses erected by the County Council.

Carlisle.—VALUE OF CONSUMERS' DEPARTMENT.—Experience at Carlisle has shown that development has been considerably accelerated by the organisation set up for demonstration and publicity. Mr. C. W. Salt, the city electrical engineer, points out in his annual report that a scheme for the hiring of electrical appliances had been in operation for fifteen years prior to the opening of the Consumers' Department and the total number of appliances on hire was 527. In the first year of the new Department's working 825 appliances were hired out, and the rate is increasing more rapidly due to their becoming better known. Facilities for the hire-purchase of apparatus were in existence for a considerable number of years, but the response was lukewarm. With the opening of the new central showrooms, however, there has been a gratifying expansion in business.

INCREASE IN SALES.—Energy sold by the Electricity Department during 1935-36 amounted to 21,928,037 kWh (12.5 per cent. increase), and Mr. Salt remarks: "The education of the people to the advantages of electricity for domestic purposes advances in a very sure manner and never loses grip. In a comparatively short time such supplies, from small beginnings, have grown to become a very important part of the output and will continue to grow." The net increase in the number of consumers was 1,888 (13.7 per cent.), which establishes a record.

Chertsey.—SUPPLY TO MENTAL COLONY.—Terms have been arranged by the Surrey County Council with the Woking Electric Supply Co., Ltd., for a supply of electricity to Botleys Park Mental Colony at £4 15s. per kVA of maximum demand, plus ½d. per kWh, the County Council to erect the necessary sub-station and pay the company £750 towards the cost of bringing in cables, and supplying and fixing switchgear and transformers.

Darlington.—LOANS.—Sanction is being sought by the Town Council to borrow £50,000 for electricity mains and services, £10,000 for electricity meters and £3,326 for high-voltage feeder cables.

NEW GENERATOR.—It is proposed to install a 20,000-kW generator at the electricity works.

Durham.—ELECTRICITY FOR COUNCIL BUILDINGS.—An amended agreement has been reached between the County Council and the North-Eastern Electric Supply Co., Ltd., for the supply of electricity to the County Council buildings.

Ebbw Vale.—CHEAPER HEATING AND POWER.—The Electricity Committee has decided to reduce the charge for electricity for heating and power from 1¼d. to 1d. per kWh.

France.—NEW TRANSMISSION LINES.—Contracts have just been placed by the authorities of Eure-et-Loir for the erection of about 50 miles of new 30,000-V power transmission lines.

Gellygaer.—LOANS.—The Urban District Council is to apply for sanction to loans of £1,000 for assisted-wiring schemes, £1,000 for hire-purchase of apparatus, £1,000 for hired apparatus, and £2,000 for unspecified mains and services.

Glasgow.—NEW PLANT.—The Cleansing Committee has approved a report by the director in regard to anticipated capital expenditure during the ensuing financial year. This includes £8,000 on alterations and additions to the plant at the Govan refuse power works and £1,750 for a further battery-charging set.

Great Yarmouth.—EXTENSIONS.—The Lothingland Rural District Council has consented to the Corporation extending low-voltage lines at Frostenden, subject to the service cable being placed underground.

Guildford.—EXTENSIONS AT PEWLEY HILL.—Owing to the increased demand for electricity in the Pewley Hill District, high voltage mains are to be laid, the estimated cost, with transformers, being £1,423.

Holland.—WATER HEATING IN AMSTERDAM.—Although electric water heating in Amsterdam has to compete with other methods using cheap fuels, it is steadily progressing. The heaters work only at night, hot water being obtained during the day by simple storage. The connections are such that

once the heater is switched off no further cold water can enter the tank. The total number of these heaters in Amsterdam has more than doubled in the past three years, rising from 13,153 in 1932 to over 27,000 in 1935. By the end of the present year it is expected that 40,000 will be in use.

Hull.—EXTENSIONS.—The Electricity Committee is seeking sanction to borrow £7,731 for extensions in Scale Lane.

A supply is also to be provided to the Hull Bridge and Tickton areas (£2,777).

PREPAYMENT METERS.—Sanction is being sought to a loan of £15,000 for prepayment meters.

POWER STATION EXTENSION.—Sanction has been obtained to loans of £279,220 for extensions at Sculcoates power station and £150,000 for mains and services.

Latvia.—NEW POWER STATION.—*Reuter's Trade Service* learns from Stockholm that, after protracted negotiations, Swedish enterprises have obtained an order for the construction of a big hydro-electric power station at Kegums, on the River Dangara (Düna), and the work is being put in hand this month. The station will at first be rated at 35,000 kW, the possibility of enlarging it to 70,000 kW being kept in view.

Newark.—MAINS AND SERVICES.—The Council is to make an application for sanction to a loan of £20,000 for mains and services.

Newton-in-Makerfield.—RESULTS AND PROSPECTS.—At the end of March last two-thirds of the premises in the district were electrified, states Mr. W. Phœnix, electrical engineer and manager, in his annual report. The Department sold 5,931,178 kWh during the year, or 20 per cent. more than in 1934-35, consumption per head of the population rising from 239 to 286 kWh. An extension in the use of electricity for street lighting would be to the mutual advantage of the Department and the Rates Fund, and efforts were being made to bring this about. Further, the Health Committee was introducing its first electric refuse-collecting vehicle, and it was to be hoped that this would encourage others to adopt electric transport. Decisions to extend the office accommodation and increase the staff of the undertaking were made, while additional land had been acquired at Newton for future development in that part of the area.

Oswestry.—LOWER CHARGES.—The Town Council has decided to reduce the charges for electricity as follows: Lighting, from 7d. to 6½d. per kWh, less 8 per cent. rebate; power from 2½d. to 2d. per kWh; prepayment meters (lighting), 8 per cent. rebate, payable on collection.

Sheffield.—ELECTRIC STREET LIGHTING.—The erection of 1,135 additional electric lamps at a cost of £4,654 has been approved by the Electricity Committee.

Stalybridge.—BOARD'S REPORT.—There was a net surplus of £25,803 on the past year's working of the Electricity Department of the Stalybridge, Hyde, Mossley and Dukinfield Tramways and Electricity Board, of which Mr. J. H. Lumsden is chief engineer. This was £4,400 more than in the previous year. Revenue from the undertaking amounted to £177,270 (£164,207) and expenditure to £124,414 (£105,803). The number of consumers rose by 3,238 to 18,288 and the total sales by 11 per cent. to 52,554,741 kWh. Power sales increased from 38,374,880 to 41,703,149 kWh and consumption on the rateable-value basis from 1,556,363 to 2,876,887 kWh. During the year the network of mains was extended by 27 to 281 miles. There was an improvement in the load-factor from 31.6 to 32.34 per cent.

Tunbridge Wells.—REDUCED CHARGES.—The Town Council has made the following reductions in charges outside the borough and at Southborough, as from the Michaelmas quarter: All-in rate, from 1d. to ¾d. per kWh and ¾d. to ½d. per kWh; flat rate for heating, cooking and power, from 1¼d. to ¾d. per kWh; and cooking specially metered, from 1d. to ¾d. per kWh. All transformer charges and meter rents, other than of slot meters, are to be abolished.

Walton-on-Thames.—LOAN SANCTIONED.—The Urban District Council has received sanction to a loan of £13,403 for mains and plant. Mains are to be extended at Burwood Park, Hersham, at the request of the Burhill Estates Co.

West Hartlepool.—INQUIRY ADJOURNED.—A public inquiry has been conducted into an application by the Corporation for the removal and placing underground of low-voltage cables which were erected in Stockton Road, Seaton Land and Owton Manor Lane, within the borough, by the North-Eastern Electric Supply Company. It was stated on behalf of the company that new circumstances had arisen recently which would need investigation, and the inquiry was adjourned for six months.

Wimbledon.—LOAN.—Sanction to borrow £30,000 for appliances for hiring has been obtained by the Electricity Committee.

Worthing.—PROPOSED WORKS.—A sub-station is to be provided in the Marine Gardens at a cost of £2,140 by the Electricity Committee, which is also to install alternating-current plant at Lansdowne Road sub-station at a cost of £1,340, and supervisory control boards at sub-stations (£520). Arrangements are to be made for a supply to Downview Court flats at a cost of £2,775 and to Ham Manor estate, Angmering (£3,000).

Mains extensions (£760) are to be carried out to supply the Seaview Estate which is being developed by the Seaside Estates Building Co., Ltd.

Hydro-electric Power in Central Asia

AN extensive system of hydro-electric power stations is being built by the Soviet authorities on the Chirchik River, to supply power for the irrigation of the Tashkent oasis and the production of fertilisers for the cotton districts of Central Asia. According to Prof. V. A. Vasiliev, of the Central Administration of Hydro-Electric Construction Work, who was responsible for the drawing up of the plans for this scheme, a 4,000 h.p. hydro-electric station was first built on the Boz-Su Canal and later another 18,000 h.p. At present a system of stations of an aggregate capacity of 60,000 h.p. is being erected on this canal. They will be able to supply the industrial and municipal needs of the city of Tashkent and the surrounding district. The main stations will be built on a 27-km. stretch on the upper part of the river, between the villages of Yamanjur and Troitskoe. Three of them will be of an aggregate capacity of 272,000 kW, with an annual output of about 1,150 million kWh. They will be the first large hydro-electric stations in Central Asia and will rank next in size in the U.S.S.R. to the Dniepr station.

The first of these three stations, at Tavak, will be of 74,000 kW. About 250 cu. m. of water, under a head of 30 m., will pass through its turbines every second. The Troitskoe station, of 112,000 kW and an annual output of 470 million kWh, will be the largest of the three. The water head of this station is 49.5 m.

The Chirchik is a turbulent mountain river with considerable alluvial deposits. It will be necessary to fight against anchor ice, and about twenty rapid tributaries which periodically deposit mud will have to be diverted. The canal between the three power stations will be built under difficult geological conditions, with a constant menace of landslides. In some places the excavations will have to be 30 m. deep. The whole canal, for a distance of 37 k.m., will have reinforced embankments and bed. The construction of a system of regulating reservoirs on the Upper Chirchik and in the mountains will increase the capacity of the stations by fifty per cent.

Nearly all the power generated by these stations will be used for the production of nitrogenous fertilisers. The first two will be ready for operation in the fourth quarter for 1937, while the entire system will be finished early in 1939. Over 21 million cu. m. of earth and rock will have to be excavated, and more than a million cu. m. of concrete laid. The scheme is estimated to cost 600 million roubles.

A considerable part of the canal and foundations of the dams have already been built and railways and roads constructed. A dam is being built below the Troitskoe hydro-electric station for the purpose of maintaining the normal working of the Tashkent oasis irrigation system during the construction of the station. Here alone, 1,500,000 acres will be irrigated.

Another important hydro-electric undertaking on which work is progressing is the Sevan-Zanga chain of stations in Armenia. When completed, this group of stations will have an aggregate generating capacity greater than that of the Dniepr hydro-electric plant. Lake Sevan, at an altitude of 6,250 ft., constitutes a natural reservoir containing over three million cu. ft. of water, separated into two parts. Thirty streams and mountain rivulets feed the lake, but only a single river, the Zanga, flows out of it.

The project provides for the construction of eight generating plants along the Zanga, which drops 3,080 ft. from its source at Lake Sevan to its junction with the Araks. The stations are to be arranged so that the diversion canals and storage reservoirs can be used for irrigation work. The aggregate capacity of the eight stations will be 559,000 kW. The first in the chain is an automatic 24,000 kW underground plant at the lake, this being already under construction. A shaft 195 ft. deep is being sunk 3¼ miles inland, with turbines and generators at the bottom and a diversion tunnel about five miles long.

Kanakir, at the bottom of a dry gorge, six miles from Erivan, is the first plant of the chain to be completed. Begun in 1933, it is about to be put into service; its ultimate capacity will be 88,000 kW. The Gumush station, work on which is to be started this year and completed in 1939, will be the biggest of the group, its ultimate capacity being 263,000 kW. The work includes the construction of a dam 1,245 ft. wide. The Arzny station, which is next in order for construction, will, when fully completed, have a capacity of 47,000 kW and an annual output of 323 million kWh.

Traction

Germany.—NEW BERLIN UNDERGROUND LINE OPENED.—The section of the underground railway connecting the Stettin railway station with Unter den Linden has been opened, states *Reuter's Trade Service* from Berlin.

Isle of Thanet.—TRANSPORT PLANS.—An agreement has been reached between the Isle of Thanet Electric Supply Co., the Margate and Ramsgate Corporations and the Broadstairs and St. Peter's Urban District Council whereby the company is to abandon its existing tramway undertaking and substitute a motor bus service. The agreement has been approved, but has not yet been executed, states the *Financial Times*. The effect of the agreement is that the company will discontinue its tramways on or before March 31st, 1937.

London.—TRANSPORT PLANS.—Orders have been placed by the London Passenger Transport Board for work to begin on the £40,000,000 scheme for improving travelling facilities in the London area. A scheme for the standardisation of the Central London Railway, to bring it into line with the others, has been passed by the Ministry of Transport. The tunnel is to be enlarged to make it uniform throughout its length, while the track will be levelled and the platforms lengthened so that faster and longer trains can be run. About £250,000 is the estimated cost of the work to be undertaken immediately. The complete £40,000,000 scheme has already been described in the ELECTRICAL REVIEW.

Communications

Germany.—OLYMPIC GAMES TELEVISION.—A report by *The Times* Berlin correspondent gives an impression that the Olympic Games television results were not entirely satisfactory. He states that three "electric eyes" and two intermediate film mobile television vans were being used by the German Post Office to televise the Olympic Games. The pictures and sound were broadcast on two ultra-short wavelengths from the Witzleben transmitter. Definition was 180 lines and there were 25 frames per second. Eighteen new public televiewing rooms had been fitted up in addition to the existing ten. Two of the rooms were small theatres employing a cathode-ray large-screen projection receiver. One had accommodation for 100 and the other for 300 people. At the Post Museum the picture on the large screen only occasionally showed shadowy outlines. Even on the ordinary set the pictures were partly unrecognisable.

South Africa.—TELEVISION.—At the Johannesburg Empire Exhibition which opens next month there is to be a television demonstration. An order has been placed with Mr. J. H. Reyner, of London, for five receivers and transmitters. A definition of 90 lines will be used for a picture 8 in. by 7 in.

Great Britain.—TELEVISION TRANSMISSIONS.—The B.B.C.'s first high-definition television station at the Alexandra Palace is now being tested. Only the sound transmitter is working so far.

AUTOMATIC EXCHANGE. — The Royal (London) automatic telephone exchange has been brought into service, and 4,100 subscribers' lines on the present exchange, together with 125 Monument subscribers' lines, are operating from the new exchange. There is provision for 5,620 exchange lines, but the potential capacity is 9,400 lines.

The completed television mast of the British Broadcasting Corporation at the Alexandra Palace, London, N.

Sweden.—NEW RADIO STATION.—The Telegraph Board proposes to erect a new radio station in the Stockholm Archipelago, learns *Reuter's Trade Service*. The station will replace the old one at Vaxholm and will, in the first place, be intended for communication with shipping. The cost is estimated at Kr.165,000.

Turkey.—BROADCASTING.—A radio station, which it is claimed will be the most powerful in the Balkans, is to be built at Chanak (Kale Sultanie) on the Dardanelles. This is one of the measures being taken by the Turkish Government to meet any emergency in the former demilitarised zone. A special credit will be voted by the great National Assembly. It will be included in the extraordinary financial allotments devoted to the refortification of the Dardanelles and Bosphorus.—*Reuter*.

Municipal Supply Undertakings' Results

Town.	Engineer.	Total Revenue.		Working Expenses.		Net Profit.		Sales of Electricity. Thousands of kWh.		Percentage Increase.
		1934/35.	1935/36.	1934/35.	1935/36.	1934/35.	1935/36.	1934/35.	1935/36.	
		£	£	£	£	£	£			
Barking	W. E. Kidner	103,302	97,690	61,045	70,815	17,983	13,915	14,170	16,767	19.0
Bath	J. W. Spark	148,281	166,341	93,128	108,521	7,727	26,881	37,308	44,119	18.2
Bingley	O. G. Cook	33,036	34,575	18,604	22,720	6,905	4,081	3,798	4,616	21.5
Birmingham	F. Forrest	2,450,913	2,613,044	1,583,018	1,718,480	257,553	255,341	553,064†	615,749†	11.3
Blackburn	R. H. Harral	225,280	235,099	124,511	135,625	17,665	21,147	34,033	39,577	16.3
Bolton	H. E. Annett	316,928	346,208	183,861	273,905	13,876	32,668	74,877	86,841	15.9
Brighton	W. N. C. Clinch	437,942	472,625	293,322	327,357	22,688	27,789	91,142†	107,469†	17.9
Bristol	A. J. Newman	844,289	990,241	452,520	625,504	37,569	107,732	161,560†	203,684†	26.0
Bromley	W. G. Trend	82,780	99,597	52,886	64,420	7,045	10,961	10,339	13,456	0.1
Burton-upon-Trent	T. Hall	165,815	182,765	107,375	107,878	10,308	21,756	32,746	37,709	15.1
Bury St. Edmunds	A. E. Knights	24,890	28,145	13,155	14,992	642	3,036	2,695	3,157	17.1
Cannock	P. Wardle	52,422	54,510	34,326	35,635	2,913	2,402	7,582	8,423	11.1
Carlisle	C. W. Salt	119,268	121,677	73,787	87,868	9,345	2,773*	19,485†	21,928†	12.5
Chester	S. E. Britton	136,989	145,499	83,445	99,848	5,357	992*	18,730	21,044	12.3
Coventry	W. J. Marston	432,025	529,895	305,294	352,939	15,908	52,856	127,320	161,806	27.0
Dover	R. C. Harpur	64,062	66,115	39,797	41,099	6,411	5,791	5,648	5,608	−0.8
Eastbourne	J. K. Brydges	185,139	221,818	134,379	179,363	9,873	625*	30,081	33,994	13.0
East Ham	W. R. Elliott	174,502	183,136	107,222	123,238	8,080	2,901	23,501	25,904	10.2
Erith	J. C. Williams	74,430	76,497	50,716	54,443	16,827	15,100	19,646	21,452	9.1
Guildford	W. E. Affleck	96,994	109,462	42,039	50,073	8,188	6,535	15,400	20,248	31.4
Hampstead	J. Leadbeater	206,175	198,782	152,895	169,538	46,242	28,793	32,062	38,432	19.8
Hastings	A. J. Ryan	198,828	221,126	121,165	148,580	16,913	11,562	33,943	41,104	21.0
Hull	J. N. Waite	629,557	672,955	424,289	483,375	61,714	41,704	151,500†	173,994†	14.8
Ipswich	H. E. Blackiston	206,112	224,142	136,418	148,596	23,584	29,390	37,385	43,719	16.9
Kettering	W. A. Walker	144,888	197,287	87,467	139,766	12,514	12,007	30,999‡	67,122‡	116.5
Leeds	C. Nelson Hefford	917,150	961,258	407,912	424,145	69,486	106,124	206,374†	230,686†	11.7
Leicester	J. Mould	575,245	637,307	366,250	398,780	55,778	56,458	103,755†	119,590†	15.2
Leigh	J. B. Hudson	63,861	69,471	42,776	46,097	7,806	9,759	13,474	14,916	10.7
Lincoln	F. Newey	97,414	108,260	69,548	78,223	9,008	9,450	23,527	25,467	8.2
Loughborough	J. P. Tucker	68,663	73,434	45,779	54,143	675	1,235	12,867	14,335	11.4
Manchester	H. C. Lamb	1,955,691	2,067,112	1,474,794	1,449,981	66,532	129,011	479,404†	498,434†	3.9
Newark	R. E. Livesley	27,257	33,367	19,840	20,220	3,042	8,570	5,666	7,248	27.9
Newton-in-Makerfield	W. Phoenix	26,021	30,002	19,641	22,123	1,243	1,884	4,927	5,931	20.3
Nottingham	G. H. Lake	655,597	725,347	392 233	425,744	37,037	63,053	102,011†	120,386†	18.0
Oldham	F. L. Ogden	324,955	315,499	196,696	198,042	25,181	26,375	63,563†	68,215†	7.3
Oxford	H. G. Fraser	186,653	173,936	93,124	90,173	43,000	22,843	26,360†	36,874	40.0
St. Marylebone	C. H. Smyth	617,723	698,663	457,149	491,858	19,530*	9,866	149,957	173,160	15.4
St. Pancras	R. Lee	359,724	394,662	218,297	248,130	37,806	37,684	55,950	63,886	14.1
Southport	E. Moxon	114,583	118,033	58,870	81,037	22,638	19,405	18,520	20,323	9.7
Stoke-on-Trent	C. H. Yeaman	296,739	324,831	250,295	291,178	46,444	33,653	67,136	79,128	17.8
Walsall	E. A. Newburn	161,466	183,291	109,141	124,088	16,067	22,097	28,320	34,383	21.4
West Ham	J. W. J. Townley	511,415	526,234	340,100	368,950	65,101	48,735	129,326†	130,917†	1.2
Wolverhampton	T. A. G. Margary	395,978	437,449	280,070	303,605	26,450	23,598	125,284	140,659	12.2
Worcester	C. M. Shaw	119,155	130,208	68,742	83,712	16,683	9,432	21,045	24,385	15.8

* Net loss.
† Excluding supplies to the C.E.B. Manchester 1934–35 sales include part of Stretford supply since taken over by C.E.B. Oxford 1934–35 sales exclude supply to the Wessex Electricity Co. now taken direct from the C.E.B. West Ham sales include a bulk supply that dropped from 14,101,789 in 1934–35 to 1,620,551 in 1935–36.
‡ Including supplies under the Corby Steelworks Agreement.

Contract Information

Where "Contracts Open" are advertised in our "Official Notices" section the date of the issue is given in parentheses

Contracts Open

Aberdare.—August 24th. U.D.C. Motors and control gear for the change-over from d.c. to a.c. (July 31st.)

Arbroath (ANGUS).—August 17th. Town Council. Electrical and heating work at Public Assistance Home, Little Cairnie. Burgh engineer (deposit £1).

Australia.—SYDNEY.—September 9th. Department of Railways (Electrical Branch). One 3,125-kVA, 50-cycle alternator and spares for the Lithgow power station. (T. 30565.)*

Barking.—August 18th. Electricity Department. Four 400-kVA transformers. (August 7th.)

Bedford.—August 27th. Corporation. Permanent fire protection installations, with automatic and manual control, in the generating station and certain sub-stations. Borough electrical engineer, Electricity Offices, Prebend Street (deposit £1 1s.).

Bexhill-on-Sea.—August 15th. Borough Council. Electrically driven centrifugal bore-hole pump. Water engineer, Town Hall.

Birmingham.—August 21st. Tramway and Omnibus Committee. Twelve trolley-bus four-wheeled chassis, complete with all electrical equipment, suitable for double-deck fifty-four seater bodies. A. C. Baker, general manager, Tramway and Omnibus Department, Council House, Congreve Street, Birmingham, 3.

August 31st. Electric Supply Committee. One set of d.c. over-voltage testing equipment. (See this issue.)

Blackpool.—August 25th. Education Committee. Engineering, plumbing and electrical installation and radio workshop equipment. (See this issue.)

August 31st. Borough Council. 6,600-V, 50-cycle, 3-phase transformers. (See this issue.)

Cardiff.—August 25th. R.D.C. Centrifugal pump and electric motor, valves, &c., for the Bonvilston water supply. W. Farrow, engineer, 20, Park Place (deposit £2 2s.).

Carlisle.—City Council. Electrical installations in 456 houses. City engineer, 18, Fisher Street.

Dundee.—August 17th. Harbour Trust. Electrical work at Harbour Chambers. Maclaren, Soutar & Salmond, architects, 15, S. Tay Street.

Eastbourne.—August 18th. Electricity Committee. Coal for six months from October 1st, next. (August 7th.)

Egypt.—CAIRO.—September 28th. Mechanical and Electrical Department, Ministry of Public Works. Air-conditioning plant for the new Chemical Department Building. Chief inspecting engineer, Egyptian Government, 41, Tothill Street, London, S.W.1 (deposit £1 10s. 9d., not returnable).

October 20th. Supply and erection of Naga Hamadi hydro-electric and electric pumping stations. Chief inspecting engineer (deposit £5 2s. 6d., not returnable.)

Fife.—August 17th. County Council. Electric lighting, &c., at houses at Limekilns. C. R. Douglas & Son, surveyors, 15, East Port, Dunfermline (deposit £1 1s.).

Finchley.—August 17th. Electricity Department. Metal-clad, air-insulated, l.v. switchgear. (August 7th.)

Folkestone.—September 14th. Corporation. Internal and external wiring of 453 houses and flats on the Canterbury Road housing estate. (August 7th.)

Frome.—August 31st. U.D.C. Two sets of electrically driven centrifugal surface pumps in duplicate, for the new well at Egford. Parker, Pearson and Ross Hooper, engineers, Dallas Chambers, Chippenham, Wilts (deposit £1).

Glasgow.—August 20th. Corporation. Electrical installations in sixty houses on the Dalmarnock Road No. 1 housing estate. Town Clerk's Office (Room 36).

India.—SIMLA.—August 27th. Stores Department. Inert cells, dry cells and sac elements for Leclanché type cells with and without ventilating tubes, as required during twelve months from December 1st, next. (T. 30539.)*

August 15th. Drilling, boring, tapping and studding machines, with motors and full electrical equipment and spares. (T. 30541.)*

August 29th. Train lighting equipment, dynamos, cut-in and out switches, lamp resistances and fuse boxes. (T.Y. 30612.)*

September 1st. Seventy-five three-pole, automatic time switches. (T.Y. 30611.)*

August 25th. Insulating materials during twelve months from December 1st, next. (T.Y. 30592.)*

Irish Free State.—DUBLIN.—August 24th. Department of Posts and Telegraphs. 3,318 telegraph poles. M. Dalton, controller of stores, P. & T. Department, Aldborough House.

Kesteven.—August 24th. County Council. Electrical work, including lighting and power installations, telephones, fire alarm points, &c., in connection with the conversion of the Bourne Public Assistance Institution. (See this issue.)

Kirkcaldy.—September 4th. Borough Council. Conversion of consumers' d.c. plant and installations for a.c. supply. (See this issue.)

Lanark.—August 17th. County Council. Electrical and heating installations at new R.C. school and County Offices, Hamilton. J. Stewart, County architect, 32-36, Albert Street, Motherwell.

London.—METROPOLITAN WATER BOARD.—October 5th. Four high-compression heavy fuel oil engines with centrifugal pumps and electrical generators, three electrically driven bore-hole pumps, switchboard and appurtenant works at the Crayford pumping station. Chief engineer, Offices of the Board, Room 235, 173, Rosebery Avenue, W.C.1 (deposit £2 2s. with the Comptroller to the Board).

Manchester.—August 25th. Electricity Committee. One motor-driven boiler feed pump for the Stuart Street power station. (July 31st.) 33,000-V single-core cable and sealing ends and 6,600-V three-core cable for the Barton and Stuart Street power stations. (See this issue.)

Midlothian.—August 17th. County Council. Electrical work in 200 houses at West Calder, Newton Grange. County architect, 10, Drumsheugh Gardens, Edinburgh, 3.

Morley.—August 26th. Housing Committee. Various works, including electrical, in fifty houses to be erected on the Baker Street estate. Borough engineer, Town Hall (deposit £2 2s.).

Newton-in-Makerfield.—August 15th. U.D.C. Electricity Department. Two 2,500-kVA transformers. (July 31st.)

New Zealand.—WELLINGTON.—November 10th. Public Works Department. One 5,000-kVA, 11-kV synchronous condenser. (T.Y. 30584.)*

October 27th. 33-kV/11-kV transformer bank. (T.Y. 30574.)*

November 3rd. Motor operated weir penstock gate and equipment for water rheostat. (T.Y. 30576.)* 22,200-kVA generator and turbine. (T.Y. 30573.)*

Northampton.—August 25th. R.D.C. Electrically driven pumping plant, &c. R. J. Miller, 1, Spencer Parade.

Northern Ireland.—BELFAST.—September 7th. Harbour Commissioners. 15-ton electrically operated travelling gantry crane (3-phase, 380-V, 50-cycles), for the Thompson graving dock. T. N. Burke, superintendent of cranes, Harbour Office.

Oldham.—August 24th. Electricity Committee. P.i., l.c., l.v. cable. (See this issue.)

Paisley.—September 4th. Corporation. Electric lighting, &c., at 782 houses on the Ferguslie Park estate. Master of Works Office, 16, Gilmour Street.

Plymouth.—August 29th. Corporation. L.v. distribution boards. City electrical engineer.

Poole.—August 20th. Town Council. Electrically driven centrifugal unchokeable type pumps, with motors in duplicate. E. J. Goodacre, borough engineer (deposit £1 1s.).

St. Helens.—August 24th. Electricity Department. Three sets of rectifying equipment. (August 7th.)

Solihull.—August 22nd. U.D.C. Internal telephones at the new Council Offices, Poplar Road. Batemans, architects, 18, Bennett's Hill, Birmingham.

South Africa.—JOHANNESBURG.—September 17th. City Council. Two 1,500-kVA and two 1,000-kVA transformers, two circuit-breaker units and link and fuse boxes, with accessories. (T.Y. 30551.)*

August 24th. Railways and Harbours Administration. Electric lamps required during twelve months from January 1st, 1937. (T. 30558.)*

September 28th. Two electric battery tractors. (T.Y. 30605.)*

CAPE PROVINCE.—September 14th. Beaufort West Municipality. Plant and equipment in connection with the commission of the local system of electrical generation and distribution, and the erection of a new power station. (T.Y. 30567.)*

PRETORIA.—September 11th. Union Tender and Supplies Board. Automatic time check apparatus, master clock, relays, oscillator and time checks. (T.Y. 30625.)*

Stoke-on-Trent.—August 25th. City Council. Electric lamps for six months ending March 31st, 1937. City surveyor, Town Hall.

Sunderland.—August 31st. Corporation. P.i. cable, r.i. wire, consumers' meters and electric lamps for twelve months ending October 31st, 1937. (August 7th.)

Swansea.—August 31st. Electricity Department. Six and a half miles of overhead 33,000-V line on galvanised steel lattice towers. (See this issue.)

Uruguay.—MONTEVIDEO.—August 20th. State Electricity Supply and Telephones Administration. 850 1,000-W lamps. (T.Y. 30538.)*

September 3rd. Sixty-eight three-phase meters for private lighting and power installations. (T.Y. 30549.)*

West Ham.—August 31st. Borough Council. Transformers. v.i.r. and tough rubber sheathed wires and cables for twelve months ending September 30th, 1937. (See this issue.)

* Further particulars from the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, London, S.W.1.

Contracts Closed

Birkenhead.—Electricity Committee. Accepted. Electrical installations in 103 houses (£419).—Park Electrical Co. Two 750-kW rectifier equipments (£4,942).—Hewittic Electric Co.

Chesterfield.—R.D.C. Accepted. Installation of a private telephone system of thirty-three points in the new offices (£355).—Yorkshire Telephone Systems, Ltd.

Coatbridge (LANARKSHIRE).—Town Council. Accepted. Electrical work at the new swimming pond, public health offices and clinic, Main Street.—E. J. Stiell & Co.

Dukinfield.—Town Council. Accepted. Electric lighting in fifty-six houses and four blocks of flats.—Mould & Corlett.

Eccles.—Electricity Committee. Accepted. 300-kW rotary convertor equipment (£1,113).—Met.-Vick. Electl. Co.

Glasgow.—Electricity Committee. Recommended. Annual contracts for 1936-37: Cables.—Callender's; Enfield Cable Works; W. T. Glover & Co.; Metropolitan Electric Cable & Const. Co.; Craigpark Electric Cable Co. Meters.—British Sangamo Co.; Chamberlain & Hookham; Ferranti; Met.-Vick. Electl. Co. Cast-iron boxes, section pillars, &c.—Falkirk Iron Co. Cable covering tiles.—H. J. Baldwin & Co.; Currie & Co.; J. & R. Howie; New Cumnock Collieries; J. Paterson & Son; Southhook Potteries.

Accepted. Twelve 800-kVA transformers.—Bruce Peebles & Co. Two 800-kVA transformers.—British Electric Transformer Co.

Education Committee. Accepted. Electrical work at the new Southcroft Street school (£1,119).—Goodwin, Smith & Co. Electrical work at various schools.—Woodward, Sons & Co.; Telford, Grier, Mackay & Co.; Small & MacDonald; W. Anderson; R. J. McIntyre; T. B. and J. A. Mathison; Claud Hamilton; H. M. Fulton; Glasgow Engineers; Haddow & Co.; Johnston Park & Co.; D. A. McLarty & Co.; Kennedy, Stark & Co.

Streets Committee. Accepted. Automatic traffic signals (£2,201).—Automatic Electric Co.

Halifax.—Town Council. Accepted. Electrical work in thirty houses on the Sandbeds estate (£205).—Woodford, Sheffield.

Kincardine.—County Council. Accepted. Electrical installations at the new cubicle block of the County Isolation Hospital, Stonehaven.—A. M'Robb, Ltd., Aberdeen.

Lanark.—County Council. Accepted. Electrical installations in thirty-eight houses at Mossend.—A. & C. Edelman, Glasgow.

Leeds.—Electricity Committee. Accepted. Sub-station switchgear.—English Electric Co. Cables.—Edison Swan Cables (£1,120); Macintosh Cable Co. (£750); Enfield Cable Works (£662); Henley's (£405); Hackbridge Cable Co. (£430); Derby Cables (£256); Telegraph Construction & Maintenance Co. (£196).

Linlithgow.—Town Council. Accepted. Wiring 158 houses. —Greig Brothers, Bathgate.

Malvern.—Worcestershire Education Committee. Accepted. Electrical installation at Technical school extension (£139).—Abell & Smith's Electrical Co., Worcester.

Northern Ireland.—OMAGH (CO. TYRONE).—Regional Education Committtee. Accepted. Electric lighting, power, heating and clocks at the new Academy and Technical School (£950). —J. Dowling & Sons, Ltd.

Scarborough.—Town Council. Accepted. Modifying the switchgear at the sub-stations in Falconars Road, Newby and Irton (£825).—Met.-Vick. Electl. Co.

Sheffield.—Electricity Committee. Accepted. Two water-tube boilers for Blackburn Meadows power station (£135,648).—Mitchell Engineering Co. Pipework and valves for Neepsend power station (£16,920).—Brightside Foundry & Engineering Co.

Smethwick.—Education Committee. Accepted. Arc welding set for the Municipal College (£118).—English Electric Co.

Todmorden.—Electricity Committee. Accepted. Switchgear. —English Electric Co.: A. Reyrolle & Co.

Warrington.—Electricity Committee. Accepted. 900-kW transformer tank (£139).—Met.-Vick. Electl. Co.

Notes

The Testing of Materials

The second international congress of the International Association for Testing Materials will be held in London from April 19th to 24th, 1937, under the presidency of Sir William Bragg and with Sir Frank Smith as chairman of the Executive Committee. The first congress was held in Zürich in 1931 with the object of obtaining international co-operation in the study of materials and their testing. The proceedings in London are to be based on selected papers (150 are already promised) divided into four groups, dealing with metals, inorganic and organic materials, and subjects of general importance. Further information is obtainable from the hon. secretary, Mr. K. Headlam-Morley, 28, Victoria Street, London, S.W.1.

Intercommunication at the Reich Stadium

To direct the spectators, accelerate the transmission of news and assist administrative work an extensive intercommunication system has been installed by Messrs. Siemens & Halske at the Reich Stadium, Berlin, where the Olympic Games are being held and which is to be used as the national headquarters of German sport. There is an automatic telephone switchboard with 500 lines in the Haus des Deutschen Sports. The main running track is equipped with a lever-type selector system with extension lines terminating in watertight plugs to which portable instruments are connected. At the swimming stadium and in certain other places there are manual exchanges. Two lever-type selector systems control loudspeaker transmissions at the Dietrich Eckardt open-air theatre, luminous signalling apparatus being provided. For the broadcasting arrangements there is an extensive telephone system with a manual exchange to which more than 300 lines are connected. An automatic exchange with fifty lines and two trunk junction boards has been provided for broadcast transmissions. The teleprinter has also been adopted on a large scale, and there is an electric clock system in which the master clock controls 150 slave dials; buzzers are incorporated to signal the first quarter in every hour. A large stop-watch mounted on the tower of the Marathon Gate advances at intervals of ten seconds and is controlled by push-buttons from the plug points around the track. The intercommunication system is supplemented by luminous signalling apparatus for competitors. In the Press Office luminous indicators show those waiting for telephone calls to which booths their lines have been connected.

National Certificates

The Board of Education has revised the Arrangements and Conditions for the Award of National Certificates and Diplomas in Electrical Engineering (Rules 127, Stationery Office, 2d.). The pamphlet sets out the procedure to be adopted by technical colleges or schools desiring to submit schemes for approval by the Institution of Electrical Engineers in conjunction with the Board. Part-time courses (150 hr. per annum as minimim) and whole-time courses are classified into "senior" and "advanced," arrangements required for examinations and the duties of examination officers are specified, and the fees payable by the school authorities are laid down. Payments should be made to the Institution of Electrical Engineers, to the Secretary of which all correspondence in connection with any matters arising out of the scheme should be addressed. Correspondence relating to the submission of schemes should be addressed to the Secretary of the Board of Education.

Geophysical Water-divining

Success has attended the introduction of what is known as the geophysical method of water-prospecting in Southern Rhodesia. In his annual report for 1935 the chief irrigation engineer contrasts the results obtained with and without the use of electrical water-divining apparatus. Drilling machines working on similarly dry and difficult sites yielded the following results:—With old-fashioned methods twenty-nine bore holes were sunk, the footage drilled being 3,304; the total cost £4,137; the number of successful bore holes five; the percentage of successful holes about seventeen, and the average cost per useful supply over £800 apiece. Working on sites indicated as suitable after geophysical prospecting, fourteen bore holes were sunk. The footage drilled was 2,412, at a total cost of £2,520, while the number of successful bore holes was ten. The proportion of successful bore holes was over 70 per cent., and the cost per useful supply £252.

Coal and Coke Analysis

As part of the work that is being carried out with regard to the preparation of standards for the sampling and analysis of coal and coke, the British Standards Institution has just issued methods for the ultimate analysis of coal and coke and for the analysis of coal ash and coke ash. They are largely based on the methods recommended by the Department of Scientific and Industrial Research in Fuel Research Paper No. 28. A shortened method of ash analysis is included which cuts down considerably the time taken by the standard method.

Copies of the specifications (Nos. 686 and 687-1936) may be obtained from the British Standards Institution, Publications Department, 28, Victoria Street, London, S.W.1, price 2s. 2d. each post free.

Appointments Vacant

Assistant meter superintendent for the Finchley Electricity Department.

Commercial manager, cashier, sales assistants, cooking demonstrator and lecturer and assistant demonstrator and sales assistant for Islington Electricity Department.

Meter fixer (mechanic) for the Workington Electricity Department.

Electrical engineer and manager for the Barnoldswick U.D.C. Electricity Department.

Probationary assistant engineer in the I.F.S. Department of Posts and Telegraphs.

Engineer to the Station Design and Installation Department of the B.B.C.

Heating engineer for the Electricity Board for Northern Ireland.

Instructor at the Bulawayo Technical School.

Assistant switchboard attendant for the Battersea Electricity Department.

Temporary electrical engineering assistants in the drawing office for the Air Ministry.

Temporary assistant engineer in the Mechanical and Vehicle Engineering Section for the Roads Department, Ministry of Transport.

(See our classified advertisements.)

Our Service Department

EVERY day inquiries of all kinds are received by the Editors, the bulk of them relating to the producers of specified classes of electrical goods. We are able to reply to most of these with the aid of our extensive records, but in a few cases we have to seek the assistance of our readers. This week we have been asked for the names and addresses of manufacturers of the following:—

COBRA (Birmingham) panel fittings.
FORBES bakelite lamp-holder.
VELOX vacuum cleaner.

Readers should enclose stamped addressed envelopes when making their inquiries.

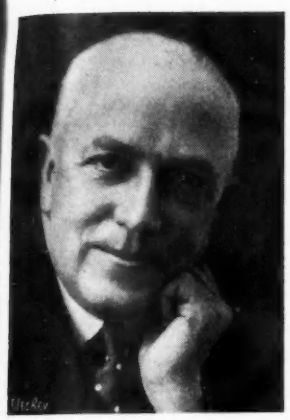
Our Personal Column

Electrical men are invited to keep readers of the "Electrical Review" posted concerning their movements

Mr. H. C. Lamb, chief engineer and manager of the Manchester Corporation Electricity Department, will read a paper on electricity supply in Great Britain from the municipal point of view at the World Power Conference to be held in Washington next month.

Mr. John C. Dalton, manager and secretary of the County of London Electric Supply Co., Ltd., and its associated companies, is leaving Southampton on the *Bremen*, on August 30th, for the United States. He will read a paper on "Public Regulation of Private Electric Utilities" at the World Power Conference.

Mr. K. R. Sturley, Ph.D., A.M.I.E.E., informs us that he is leaving the "Mazda" valve laboratories of the Cosmos Lamp Works, Ltd., to take up a position with the Marconi Company at its School of Wireless Communication, Chelmsford.

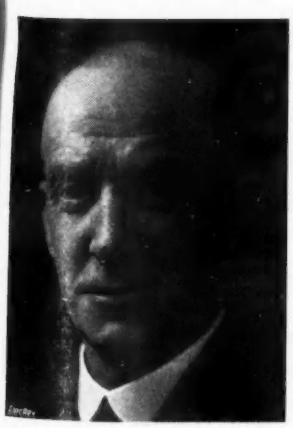


Mr. A. G. Foster

Mr. Alan G. Foster, M.I.Mech.E., has been appointed director and general manager of Messrs. J. Browett Lindley (1931), Ltd., and general manager of the Campbell and Coburn Engine Departments of Messrs. Kryn & Lahy (1928), Ltd. Mr. Foster commenced his career as a pupil with Brown, Marshall & Co.'s Works in Birmingham, continuing with the Birmingham Railway Carriage & Wagon Co., Ltd., where he became chief draughtsman, and then with Cravens Railway Carriage & Wagon Co., Ltd., of Darnall, Sheffield, where he was general manager for a number of years. Subsequently (from 1915 to 1929) Mr. Foster became an executive director of Clayton & Shuttleworth, Ltd., and Clayton Wagons, Ltd., of Lincoln. Before joining the Letchworth concerns with which he is now associated, Mr. Foster was actively engaged in a works re-organisation scheme of the English Electric Co. In addition to his wide experience of the management and production side of heavy egineering, he has also travelled on commercial matters to most parts of the world in the interests of his companies.

Mr. G. B. Pierpoint, of the State of Guernsey Electricity Department, has been appointed consumers' engineer by the South Shields Town Council at a commencing salary of £405 per annum. Previous to his appointment at Guernsey Mr. Pierpoint was consumers' engineer with the Dumfries-shire County Council Electricity Department.

Mr. Watson Deans has found it necessary, for private reasons, to resign from the presidency of the Electrical Contractors' Association of Scotland, and **Mr. H. M. Fulton** has been elected to succeed him. Mr. Fulton, who is a Glasgow man, was educated at John Street Secondary School and the Royal Technical College, Glasgow, and served his apprenticeship with Messrs. Claud Hamilton, Ltd. During his thirty-nine years' association with the electrical industry, he has had a wide and varied experience in all its branches, including a term at sea as second engineer. He established his own business in Glasgow sixteen years ago. Mr. Fulton has been a member of the central board of the Association for several years, and was chairman of the Glasgow branch in 1934-5. He has also taken an active part in civic affairs, holding the chair of the Dalmarnock Ward Committee, and being a member of the Committee for Old Age and Blind Person's Pensions. He is a Burgess and Freeman of the City of Glasgow.



Mr. H. M. Fulton

Mr. J. H. Candish, of the Post Office Engineering Department at Tunbridge Wells, has retired after forty-four years' service, and has been presented by his colleagues with a cheque and a case of pipes.

Mr. N. R. Elliott, M.A. (Cantab), Ll.B., A.M.Inst.C.E., A.M.I.E.E., has been appointed deputy electrical engineer and manager with the Ilford Corporation Electricity Department. Mr. Elliott was with Messrs. Stephen Sillon & Partners, consulting engineers, being appointed assistant engineer and then resident engineer on a big construction contract in the Dearne Valley, Yorkshire. At the end of the contract he returned to the London office as personal assistant to Mr. A. R. Hoare, the senior partner of the firm. From 1928 to 1932 he was with the London Underground Railway Group, and during the next three and a half years he was with the London and Home Counties Joint Electricity Authority, being appointed personal assistant to Mr. F. W. Purse. For the past year he has been connected with the Yorkshire Electric Power Co. and its associated companies, as commercial assistant to Mr. W. B. Woodhouse.

Mr. N. R. Elliott

Mr. H. Roberts, who is at present in the Skipton Electricity Department, and who was formerly showroom manager to the Colwyn Bay Corporation, has been appointed consumers' engineer to the Basingstoke Electricity Department.

Mr. W. N. Pritchard

Mr. S. Lambert retired from the position of engineer and manager to the Market Drayton Electric Light and Power Co., Ltd., on August 1st last, having been with the company since its formation in 1902 and as manager since 1911. Previous to 1902 he was with the L.M.S. Railway and Crewe Corporation Electricity Departments. He is succeeded by **Mr. W. N. Pritchard,** who has been assistant engineer at Market Drayton since 1919. Mr. Pritchard received his training at Market Drayton, and was afterwards engaged at Ventnor and Newport (I.O.W.) electricity works, and also in the Electrical Engineer's Department at Devonport and Rosyth Royal Naval Dockyards.

Mr. B. P. Hutton, who has been engaged on sales and publicity for Messrs. Marryat & Scott, Ltd., in London, has been appointed to represent the company in the Midlands at 52, Wheeleys Road, Edgbaston, Birmingham (Tel.: Calthorpe 2336).

Mr. B. P. Hutton

Mr. E. J. Jennings, secretary of the South-West Midlands Electricity Advisory Committee, and until recently of the Birmingham Electricity undertaking, has obtained six months' leave of absence for the purpose of making an extended tour of Australia and New Zealand, and will be glad to make contact with friends overseas. He will not sail until towards the end of October. While Mr. Jennings is away communications should be addressed to his private residence, "Arden Lodge," Forest Road, Moseley, Birmingham, where they will receive attention.

Mr. E. D. T. Vane has relinquished his position with the British Thomson-Houston Co., Ltd., to join Messrs. Young & Wildsmith, Ltd., as manager of their branch at Reading.

Miss Shelagh L. Browning, of Santon, Ltd., with the cup presented to her for winning the English national long-distance swimming championship. (See page 219.)

Mr. E. H. Skinner has been appointed assistant borough electrical engineer to the Colchester Corporation at a salary of £500, rising to £600, per annum. The Finance Committee has resolved that a superannuation allowance of £403 per annum shall be granted to **Mr. W. Frisby,** retiring borough electrical engineer.

Mr. J. D. Knight, former borough electrical engineer at Ealing, is to offer himself as a candidate for the Grange Ward at the forthcoming Ealing Council elections in November.

Mr. B. W. Simpson, who has had extensive cable experience at home and overseas, has been appointed to represent Derby Cables, Ltd., in the Lancashire, Yorkshire, Cheshire and North Wales area. His offices are at 42, Deansgate, Manchester.

Mr. H. F. Hunt, B.Sc., A.M.I.E.E., whose retirement from the position of superintending electrical engineer, H.M. Dockyard, Portsmouth, was briefly recorded in our last issue, joined the Admiralty service as an electrical engineer in 1903, and thus completed thirty-three years' service prior to his retirement on reaching the age limit last month. During this period he had seen duty at the Admiralty, Pembroke, Simonstown, Malta, Devonport, Rosyth and finally, for the past 5½ years, as head of the Electrical Engineering Department at Portsmouth Royal Naval Dockyard, with a staff approaching 2,000 officers and men. The Dockyards have their own power stations, and the output exceeds that of a fair-sized town, while the application of electricity in ships covers all phases of development from heavy electrical engineering to the complex control and communication systems. At a recent social gathering Mr. Hunt was presented by his colleagues and staff with a grandfather chiming clock and a radio set, and Mrs. Hunt with a tea salver.

Mr. C. W. Goyder, late of the B.B.C. Research Department, left England on Tuesday last by air for India, where he is taking up the position of chief engineer of All-India Radio.

Obituary

Mr. R. H. Paterson.—We regret to record the death of Mr. Robert Howie Paterson, which occurred on August 10th, at Barnes. Mr. Paterson was formerly borough electrical engineer at Hammersmith, resigning from that position in 1933 owing to ill-health.

Mr. F. S. Stacey.—We regret to learn as we go to press of the death of Mr. Francis Samuel Stacey, chief of one of the Contracts Sections of Marconi's Wireless Telegraph Co., Ltd., which occurred on Tuesday last at the age of fifty-six. We hope to refer more fully to his career in our next issue.

Lt.-Col. A. E. F. Fawcus, D.S.O., M.C., who was killed in the aeroplane crash at Pagham on Monday last, was the second son of the late Mr. W. P. J. Fawcus, of Keswick, a prominent consulting electrical engineer many years ago.

Wills.—Mr. P. A. Constantine Ribton, principal of Messrs. C. P. Ribton, Ltd., electrical engineers, left £3,109.

Mr. Edgar Allan Wallis, formerly resident director of the Venezuelan Telephone & Electrical Appliances Co., left £25,921, with net personalty £25,817.

Financial Section

New Companies. Official Returns of Capital. Debenture Charges. Reports of Electrical Companies. Dividend Announcements. Transactions in Stocks and Shares

New Companies Registered

The Marconi-Ekco Instruments, Ltd.—Private company. Registered August 6th. Nominal capital £5,000. The shares are to be issued in equal proportions to Marconi's Wireless Telegraph Co., Ltd., and E. K. Cole, Ltd. Objects: To carry on the business of manufacturing, assembling, repairing, buying, selling, importing, exporting and dealing in measuring instruments of all kinds (electrical or otherwise), diathermy and other medical apparatus, refrigerators, &c., and to adopt an agreement, dated July 9th, 1936, made between Marconi's Wireless Telegraph Co., Ltd., and E. K. Cole, Ltd. The directors (to number not less than two nor more than seven) are: Lord Inverforth, P.C. (chairman), The Hill, Hampstead, N.W.3; H. A. White, The Minster House, St. James Court, Buckingham Gate, S.W.1; H. R. Corby Van de Velde, Ravenleigh, Bletchworth, Surrey; E. Wilshaw, Arundel House, Arundel Street, W.C.2; W. S. Verrells, Forest Garth, Bransgore, Hants; and E. K. Cole, Leeways, Marine Parade, Leigh-on-Sea. Not more than three of the directors are to be appointed by Marconi's Wireless Telegraph Co., Ltd., and not more than three by E. K. Cole, Ltd. The chairman is to be appointed jointly. Messrs. H. A. White, H. R. C. Van de Velde and E. Wilshaw are deemed to be appointed by Marconi's, and W. S. Verrells and E. K. Cole by Ekco. Secretary: L. J. King, A.C.I.S. Registered office: Electra House, Victoria Embankment, W.C.2.

U.S. Radio, Ltd.—Private company. Registered August 7th. Capital, £500. Objects: To carry on the business of radio and television engineers, experts and contractors, electrical engineers, &c. The directors are: H. Constad, 943, Finchley Road, London, N.W.11; and S. H. Sidders, Latymer, Meadway, Ruislip. Secretary: S. H. Sidders. Registered office: 138, Southwark Street, London, S.E.1.

Irish Neonlight, Ltd.—Private company. Registered in Dublin August 4th. Capital, £2,000. Objects: To manufacture, hire, procure on the hire-purchase system or otherwise acquire all kinds of neon and other signs and electrical goods, &c. The directors are: M. J. McCabe, 18, Clyde Road, Ballsbridge, Dublin; and J. C. Moorkens, 195, Strand Road, Merrion, Dublin.

Mechanical Totalisators, Ltd.—Private company. Registered August 8th. Capital, £1,000. Objects: To manufacture, sell and/or lease totalisators or other mechanical contrivances, whether worked by electricity or other motive power and/or by hand, &c. The directors are: G. M. Bethell, 88, Cornwall Gardens, Kensington, S.W.7, and two others. Registered office: 3, St. James's Square, S.W.1.

John Stamper, Ltd.—Private company. Registered August 8th. Capital, £500. Objects: To carry on the business of wholesale and retail radio, electrical, and television dealers, &c. The subscribers are: J. R. S. Stamper, Station Road End, Cross Gates, Leeds, and two others. Secretary: J. R. S. Stamper. Registered office: 91, Cookridge Street, Leeds, 2.

Loan-a-Radio (London), Ltd.—Private company. Registered August 7th. Capital, £1,000. Objects: To carry on the business of wholesale and retail dealers in radio apparatus, &c. The subscribers (each with one share) are: Leslie C. Beaver, 184, King's Court, Ravenscourt Park, W.6; and J. C. Helme, 27, Chancery Lane, W.C.2. L. C. Beaver is the first director.

Lilly Radio, Ltd.—Private company. Registered August 7th. Capital, £300. Objects: To carry on a radio, television and electrical business in all its branches, &c. The directors are: Capt. Chas. O. Lilly, 78, Bridge Lane, N.W.11; and H. L. Watkins, 31/33, Bishopsgate, E.C.2. Registered office: 31/33 Bishopsgate, E.C.2.

A. & G. Studio Lighting & Equipment Co., Ltd.—Private company. Registered August 4th. Capital, £5,000. Objects: To acquire the goodwill and certain other assets of the business carried on by E. R. Gourdeau as "A. & G. Studio Lighting & Equipment Company." The directors are: E. R. Gourdeau, 632, London Road, Isleworth, and C. H. Travis, 12, Daneshill, Prestwich, Manchester. Secretary: F. A. Jennings. Registered office: Ergon Works, Worton Road, Isleworth.

Musgrove & Johnson, Ltd.—Private company. Registered July 31st. Capital, £1,000. Objects: To acquire the business of radio and electrical dealers and electricians carried on by R. Musgrove and E. V. Johnson at 331 and 333, Shirley Road, Southampton. The directors are: R. Musgrove, Wynford, Belbins Romsey, Hampshire, and E. V. Johnson, Caldy, Testwood Place, Totton, Southampton. Office: 331, Shirley Road, Southampton.

Geo. Becker, Ltd.—Private company. Registered August 1st. Capital, £1,000. Objects: To acquire the business of manufacturers of electrical accessories carried on by Geo. Becker, Ltd., at Ampere Works, Wembley Park, Middlesex. The directors are: B. Becker and M. Becker, both of 29, Forty Lane, Wembley Park. Secretary: Sarah L. Becker. Registered office: Ampere Works, Wembley Park, Middlesex.

Super Lighting Fittings, Ltd.—Private company. Registered July 27th. Capital £100. Objects: To carry on the business of electricians, manufacturers of and dealers in electrical fittings, etc. The permanent directors are: B. Bernard, 40, Leicester Rd., Blackpool, traveller; and S. Lesofsky, 72, Dollis Hill Avenue, N.W.2. Registered office: 6 and 7, Fonthill Mews, Lennox Rd., N.4.

F. W. Taylor & Son, Ltd.—Private company. Registered August 1st. Capital, £6,000. Objects: To acquire the business of an electrical engineer carried on by N. Taylor at Albion Works, Milnsbridge, nr. Huddersfield. The directors are: N. Taylor and H. Taylor, both of "Oakwood," Royd Street, Golcar, nr. Huddersfield. Solicitors: Owen Bailey & Hulme, Yorkshire Bank Chambers, Huddersfield.

Farrex Radio, Ltd.—Private company. Registered July 30th. Capital, £2,000. Objects: To carry on the business of manufacturers and distributors of radio receivers, television apparatus, &c. The directors are: R. D. Farrant (managing director), 31, Adelaide Road, London, N.W.3, and R. Farrant, 31, Queens Road, Coventry.

G. H. Fulton, Ltd.—Private company. Registered August 4th. Capital, £1,000. Objects: To acquire the business of radio retailers, engineers and repairers of radio sets, gramophones and radiogramophones carried on by G. H. Fulton at Staines. The directors are: G. H. Fulton and Mrs. I. L. Fulton, both of 57, London Road, Staines, Middlesex. Registered office: 57, London Road, Staines, Middlesex.

I. Pearson & Sons, Ltd.—Private company. Registered August 5th. Capital, £2,000. Objects: To carry on the business of electrical and general engineers, motor and oil fuel engineers, ironfounders, &c. The directors are: I. Pearson (permanent), 205a, Bentley Road, Doncaster, and four others.

Returns of Electrical Companies

Kingsway Electricals, Ltd.—Particulars filed of debentures for not more than £1,500, authorised July 17th, 1936, charged on the company's undertaking and property, present and future, including uncalled capital (ranking *pari passu* with £3,000 debentures created May 25th, 1936), the amount of the present issue being £1,500.

Issue on July 30th, 1936, of £200 debentures, part of a series already registered.

Broadcast Relay Service (Clacton), Ltd.—Capital, £7,000 in 3,500 preference and 3,500 ordinary shares of £1 each. Return dated May 8th, 1936. 3,400 preference and 3,500 ordinary shares taken up. £3,400 paid on the preference shares. £3,500 considered as paid on the ordinary shares. Mortgages and charges, nil.

Seaton & District Electric Light Co., Ltd.—Capital, £30,000 in £1 shares. Return dated May 1st, 1936. All shares taken up. £30,000 paid. Mortgages and charges, nil.

R. Moore & Son (Electricians), Ltd.—Capital, £1,000 in £1 shares. Return dated June 19th, 1935 (filed May 7th, 1936). 400 shares taken up. £400 paid. Mortgages and charges, nil.

Electrical Facilities, Ltd.—Return dated June 18th, 1936. Capital, £350,000 in £1 shares. 200,000 shares taken up. £200,000 paid. Mortgages and charges, nil.

Simpson, Baker & Co., Ltd.—Capital, £20,000 in £1 shares. Return dated March 27th, 1936. All shares taken up. £20,000 paid. Mortgages and charges, nil.

Richard W. Foote, Ltd.—Debenture, dated July 27th, 1936, to secure £500, charged on the company's undertaking and property, present and future, including uncalled capital. Holders: J. Wuidart & Co., Ltd., 26/28, Bartletts Buildings, Holborn Circus, E.C.

Veritys, Ltd.—Particulars filed of £10,000 second debentures (series "B"), authorised July 9th, 1936, charged on the company's undertaking and property, present and future, including uncalled capital, the whole amount being now issued.

Douglas Electric Lighting Co., Ltd.—Capital, £3,500 in 3,450 preference shares of £1 and 1,000 ordinary shares of 1s. Return dated December 31st, 1935 (filed April 23rd, 1936). 2,000 preference and 1,000 ordinary shares taken up. £2,050 paid. Mortgages and charges, nil.

Western Electric Co., Ltd.—Capital, £20,000 in £1 shares. Return dated April 13th, 1936. All shares taken up. £20,000 paid. Mortgages and charges, nil.

Thomas Kesnor & Co., Ltd. (formerly Watford Electric & Manufacturing Co., Ltd.; original title, Thomas Kesnor and Co., Ltd.).—Satisfaction (1) to the extent of £1,000 on July 6th, 1936, of debentures authorised May 31st, 1923, and registered June 11th, 1923, and (2) in full on June 24th, 1936, of debenture dated August 22nd, 1929, and registered August 26th, 1929. (According to the register of mortgages, the debenture registered June 11th, 1923, originally secured £4,000, and the debenture registered August 26th, 1929, £3,000.)

Satisfaction in full on July 21st, 1936, of mortgage dated November 16th, 1920; conveyance dated May 9th, 1922, and further charge dated May 24th, 1935, and registered November 27th, 1920, May 26th, 1922, and May 25th, 1935, respectively.

Wakelins Wireless Co., Ltd.—Capital, £2,500 in 1,250 preference and 1,250 ordinary shares of £1. Return dated December 31st, 1935 (filed April 30th, 1936). 135 ordinary shares taken up. £102 paid, £33 considered as paid. Mortgages and charges: £569 17s. 8d.

Frank Angell & Co., Ltd.—Capital, £1,000 in £1 shares. Return dated March 2nd, 1936. 851 shares taken up. £851 paid. Mortgages and charges, nil.

Bristol's Instrument Co., Ltd.—Charge on freehold factory premises and land in Brent Crescent, North Circular Road, Willesden, dated July 18th, 1936, to secure all moneys due or to become due from the company to the Westminster Bank, Ltd.

Edison Bell (1933), Ltd.—Debenture dated July 27th, 1936, to secure £2,000 charged on the company's undertaking and property, present and future, including uncalled capital, and all sums due or to become due to the company from Phonographic Performance, Ltd. Holders: The Beattie Trust, Ltd., 17, John Street, Adelphi, W.C.2.

Satisfaction in full on July 27th, 1936, of debenture dated December 13th, 1935, and registered December 31st, 1935, securing £1,750.

Electricars, Ltd.—Mortgage, dated July 20th, 1936, to secure all moneys due or to become due from the company to Barclays Bank, Ltd., on agreement dated June 10th, 1936, benefit thereof, and all moneys payable thereunder, or under any agreement substituted therefor, whether for vehicles, batteries or otherwise.

City Notes

Associated Electrical Industries, Ltd.—At an extraordinary meeting held on August 11th a resolution was passed increasing the capital to £6,495,000 by the creation of 100,000 new 8 per cent. cumulative preference shares of £1 each. Sir Felix Pole (chairman), who presided, explained that the new capital was required in order to acquire the outstanding preference and ordinary shares in the Edison Swan Electric Co., Ltd. It was proposed to offer the holders of shares in the Edison Swan Electric Co. an exchange of shares by the issue of one fully-paid 8 per cent. cumulative preference share in the Associated Co. in exchange for one fully-paid 7½ per cent. cumulative preference share in the Edison Swan Co., and three fully-paid £1 ordinary shares for every five fully-paid 4s. ordinary shares in the Edison company.

The Lancashire Dynamo & Crypto, Ltd., is holding an extraordinary meeting on August 26th at which a resolution will be submitted for increasing the company's capital by the creation of 60,000 additional ordinary shares of £1 each. The ordinary capital will be raised to £320,000. It is understood that these new shares will not be issued immediately, but only when and as required. The directors announce that they will redeem the outstanding 5 per cent. first mortgage debentures amounting to just over £40,000 at the end of the year.

The Electrical Finance & Securities Co., Ltd.—At an extraordinary meeting held on August 6th approval was given to a resolution increasing the capital of the company to £500,000 by the creation of 75,000 additional ordinary shares of £1 each and 75,000 undenominated shares of £1 each.

Edmundson's Electricity Corporation, Ltd., reports that the results of the operations of its group of companies during July, as compared with the corresponding month of 1935, show an increase of 21 per cent. of kWh sold.

The National Gas and Oil Engine Co., Ltd., is paying an interim dividend of 2½ per cent. on the arrears of preference shares, less tax, for the six months ended December 31st, 1935.

Lissen, Ltd., is paying the dividend on the 8 per cent. cumulative preference stock for the six months ended June 30th on September 1st next.

W. Canning & Co. have declared an interim dividend of 5 per cent., less tax, in respect of the six months' trading to June 30th (same).

The Rangoon Electric Tramway & Supply Co. is paying an interim dividend of 6 annas per share, free of Indian tax, on the ordinary shares.

The South Metropolitan Electric Light & Power Co., Ltd., is paying an interim ordinary dividend of 3 per cent., actual (unchanged).

The Folkestone Electricity Supply Co., Ltd., is maintaining its interim ordinary dividend at 4 per cent., tax free.

Waste Heat & Gas Electrical Generating Stations, Ltd., is maintaining its interim dividend at 2½ per cent.

Waygood-Otis, Ltd., is again paying an interim dividend of 12½ per cent.

Stocks and Shares

TUESDAY EVENING.

THE principal features of activity in the Stock Exchange markets at the present time are to be found in the various industrial sections, where the daily evidence of increasing trade provides a powerful incentive to draw money into the ordinary shares of commercial and industrial companies known to be doing well. As an instance of what is actually going on, we may mention that one of the big financial institutions spread £100,000 last week over the ordinary shares in a carefully selected list of industrial companies. This money, which in the ordinary way would have gone automatically, so to speak, into gilt-edged securities, has been invested in the Equity class on the assumption that, taking the longer view, gilt-edged stocks are more likely to decline in value than to appreciate. Offering, as they do, a very small net return, this argument contends that fixed-interest issues are likely to prove more vulnerable to any rise in the price of money than are the ordinary shares in companies whose financial requirements, due to expansion of their trade, might be the primary cause of money becoming dearer.

It will be noticed by reference to our price lists that the ordinary shares of electricity supply companies—London, Scottish and Provincial—give an average return of under 4 per cent. on the money. In spite of the modesty of this yield, however, capital flows constantly into these shares. The supply, notwithstanding occasional new issues, barely suffices to meet the demand.

Another financial feature of the past few days has been a fairly general recovery in the stocks of the British railway companies, the improvement being due to the excellence of the traffics.

Electricity Supply Shares

Restrictive influences, both seasonal and political, have deprived the market for electricity supply shares of any noteworthy animation. There has been some quiet buying of North Eastern Electrics, which are being recommended as a promising holding in view of the company's participation in the growing industrial activity of Northumberland and Durham. The company supplies current in both those areas. The price of the shares is 1s. up at 35s. Electricity Supply Corporations recovered to 58s. 3d. County of Londons gained, and Scottish Power lost a few pence: otherwise quotations in the group are scarcely changed, except where interim dividends have been deducted.

Ratification of the agreement for the return from America

to this country of controlling interest in Edmundson's Electricity Corporation, produced nothing more important than a sixpenny gain in the company's ordinary shares. Electrical Finance and Securities made no response to news of particulars of the foreshadowed capital increase, or to the favourable terms upon which it is intended shortly to offer the new shares to existing holders.

In the overseas group, Palestine Electric "A" shares are harder at 47s. East Africans, 30s. 9d., show a ninepenny rise. Perak Hydros, 27s. 9d., have an easy tendency.

The Yield on Preference Shares

A yield of nearly four guineas per cent. can be obtained from the Llanelly and District Electricity Supply Company's 6 per cent. cumulative £1 preference shares. An issue was made recently, and a line of the shares is on offer, in the form of renounced allotment letters, at 28s. 9d., free of stamp duty and fee. A full six months' dividend is due in February. The last three ordinary dividends have each been 5 per cent. Profits in 1935 were sufficient to cover the preference dividend two and three times over.

The yield looks good against the returns to be obtained from comparable issues in some of the bigger supply companies. Clyde Valley Power 6 per cent. preference shares, the dividend upon which was covered as many as twenty-two times over by the last-published profits, yield only £3 11s. 6d. to buyers at 33s. 6d., the price at which a few thousand are on offer. Shropshire, Worcestershire and Staffordshire 6 per cent. preference, offered at 31s. 6d., yield £3 16s. per cent. on the money. The safety margin here is about three-and-a-half times in excess of dividend requirements.

A.E.I. and Edison Swan

An explanation of the decision taken by Associated Electrical Industries to add 100,000 new 8 per cent. preference shares to the present authorised capital, is to be found in news of the offer made to holders of Edison Swan preference and ordinary shares to exchange their holdings into corresponding A.E.I. shares. Details of the scheme were given to-day, Tuesday, at a meeting of the latter company, which is pursuing a policy of consolidating financially the group of companies which it controls. Edison Swan has a capital of £100,000 in 7½ per cent. £1 preference shares, and £191,435 in 4s. ordinary shares. Associated Electrical Industries have, unissued at present, 263,490 shares of the authorised ordinary capital. By enlarging the preference capital, the A.E.I. company will be placed in a position to give effect to the Edison Swan scheme. Edison preference shares are quoted at 30s. Associated Electrical ordinary are strong at 53s. 6d., the preference have fallen 1s. to £2.

Equipment and Manufacturing

Although business in the electrical equipment share market has dwindled to some extent, quotations of the leading shares are all strong. Callenders are higher at 4½. Henleys, Enfields, General Electrics and Associated are all up. Semi-speculative attention is being directed towards English Electric issues, reports of good current trading having revived the interesting question of dividend prospects. The ordinary shares strengthened 2s. 6d. to 27s., and the preference 1s. to 28s. Siemens continued in favour, and rose ⅛ further to 31s. 3d. Telegraph Condensers are a similar amount to the good at 2½. Lancashire Dynamos are, according to the Stock Exchange official list, nominally unaltered, but are changing hands about 1s. 6d. lower than the 2⅞ quoted. The company proposes to create, but not necessarily to issue at once, 60,000 new £1 ordinary shares, and to redeem the outstanding 5 per cent. debenture loan at the end of this year. Hall Telephones are a trifle reactionary at 23s. 6d.; International Automatic ordinary are firm at 49s. Of the newly issued ordinary shares, which can still be bought free of stamp duty and fee, General Electrics stand at 84s. 3d., Hall Telephones at 23s. 9d., and Telephone Manufacturing at 10s.

Miscellaneous Matters

In the Stock Exchange account which finished on Thursday in this week, and which included the August Bank Holiday, the volume of business turned out to be on a larger scale than the industrial market has seen for some time past. The official Clearing House Department of the Stock Exchange, which, more than anything else is responsible for the smooth running of the bi-monthly settlement, dealt with an exceptionally large number of bargains, the iron, steel and heavy industries providing a goodly proportion of the business. It is hardly necessary to add that the popularity of shares in this industry finds reflection in those of other branches which are affected indirectly by trade activity. The extensive spending programmes of the railway and other companies are held, naturally, to be indicative of plenty of employment being assured for the whole of next year, at any rate; and probably for longer. Consequently, investment is searching for such companies as are likely to come into the circle of favour to which the area of expenditure will extend. The electrical equipment and manufacturing companies may be expected to receive their full share of orders in connection with the heavy trades as a whole. On the strength of this supposition, the shares are being absorbed by such buyers as those mentioned in the first paragraph. In certain markets there is very little doing: the rubber share market is a case in point.

Share List of Electrical Companies

	Nom.	Dividend. Previous.	Dividend. Last.	Price. Aug. 11.	Rise or Fall.	Yield p.c. £ s. d.
HOME ELECTRICITY COMPANIES.						
Bournemouth and Poole	1	15	15	77/6	—	3 17 5
City of London	1	7½	7½	37/–	—	4 1 1
Clyde Valley	1	7	8	45/–	—	3 11 1
County of London	1	10½	10½	54/6	+6d.	3 17 2
Edmundson's 7% Pref.	1	7	7	35/6	—	3 19 0
Do. Ord.	1	8	8	44/–	+6d.	3 12 7
Elec. Dis. Yorkshire	1	9	9	47/–	–1/–	3 16 7
Elec. Fin. and Securities	1	12½	12½	3½	—	3 11 5
Elec. Supply Corporation	1	11	11	58/3	+⅛	3 15 7
Lancs Light and Power	1	7½	7½	38/–	—	3 19 0
Lond. Assoc. Electric	1	—	7	35/–xd.	+6d.	4 0 0
London Electric	1	7	8	39/6xd.	+6d.	4 1 1
London Power Deb. Red.	Stock	5	5	108½	—	4 12 2
Metropolitan	1	10	10	51/–xd.	+6d.	3 18 5
Midland Counties	1	7	7½	39/–	—	3 17 0
Mid. Elec. Power	1	8	8	45/–	—	3 11 1
North Eastern Electric Ordinary	1	6	6	35/–	+1/–	3 8 7
Do. 7% Pref.	1	7	7	36/–	+6d.	3 17 9
Northampton	1	10	10	52/6xd.	+6d.	3 16 2
Notting Hill 6% Pref.	10	6	6	14½	—	4 4 3
North Met. Elec. Ordinary	1	10	10	55/–	—	3 12 9
Do. do. 6% Pref.	1	6	6	32/6	—	3 13 10
Scottish Power	1	8	8	42/6	–6d.	3 15 5
South London	1	7	7	34/6	—	4 1 5
Whitehall Elec. Invst. 7½% Pref.	1	7½	7½	23/–	–6d.	6 10 5
Yorkshire Elec.	1	8	8	44/–xd.	–6d.	3 12 9
PUBLIC BOARDS.						
Central Electricity, 1950–70	Stock	5	5	116½xd.	—	4 5 9
Do. 1955–75	„	5	5	120	—	4 3 4
Do. 1951–73	„	4½	4½	111	—	4 1 1
Do. 1963–03	„	—	3½	104	—	3 7 4
London Elec. Trans. Gtd.	„	—	2½	96	—	2 12 1
London & Home Counties, 1955–75	„	4½	4½	114	—	3 19 0
London Passenger Transport, A	„	—	4½	122½	—	3 13 6
Do. do. B	„	—	5	128½	—	3 17 10
Do. do. C	„	3½	4	105	—	3 16 2
West Midlands Joint Elec. 1948–68	„	—	5	116½	—	4 5 10
TELEGRAPH AND TELEPHONE.						
American Tel. & Tel.	$100	9	9	174½	+4	5 3 0
Anglo-Am. Tel. Pref.	Stock	6	6	127½	—	4 14 1
Do. Def.	„	1½	1½	31½	+½	4 15 3
Cable & Wireless 5½% Pref.	„	4½	5½	102	—	5 7 10
Do. A. 7½% Ord.	„	Nil	Nil	21½	+½	—
Do. B. Ord.	„	Nil	Nil	6½	—	—
Globe Tel. & Tel. Ord.	10	3½*	4½*	14½	—	3 3 1
Do. Do. Pref.	10	6	6	14½	—	4 3 6
Great Northern Tel.	10	20	20	45	—	4 9 6
Marconi-Marine	1	10	7½	33/9	—	4 9 0
Oriental Telephone Ord.	1	12*	12*	3½	—	3 13 10
HOME AND FOREIGN TRAMS, ETC.						
Anglo-Arg. Trams First Pref.	5	Nil	Nil	1/–	—	—
Do. do. 2nd Pref.	5	Nil	Nil	9d.	—	—
Do. do. 5% Deb.	Stock	Nil	Nil	5	—	—
British Electric Traction Df. Ord.	„	5	5	1450	—	—
Do. do. Pref. Ord.	„	8	8	175½	—	4 11 5
Brazil Traction	100	—	30 cts.	12	—	—
Brit. Columbia Elec. Rly. Pce.	Stock	5	5	102½	—	4 17 7
Mexican Light Common	100	Nil	Nil	3½	—	—
Do. 1st Bonds	$500	5	5	45	–6	—
Victoria Falls Ord.	1	20	12	3⅞	–⅛	3 1 10
West Riding	1	5	6½	50/–	—	2 12 9
MANUFACTURING COMPANIES.						
Aron Electricity Ord.	1	10	15	65/–	—	4 12 4
Assoc. Elec. Ord.	1	6	8	53/6	+1/6	3 0 0
Do. Pref.	1	8	8	40/–	–1/–	4 0 0
Babcock & Wilcox	1	8	8	52/–	–3d.	3 1 6
British Aluminium Ord.	1	7½	7½	39/6	+6d.	3 16 0
British Insulated Ord.	1	15	20	5½	+⅛	3 11 0
Brush Ord.	Stock	Nil	Nil	41	+1½	—
Callender's	1	15	15	4½	+⅛	3 6 7
Do. 6½% Pref.	1	6½	6½	32/6	—	4 0 0
Crompton Parkinson Ord.	5/–	—	12½	4½	—	—
Do. 8% Pref.	1	8	8	38/9	—	4 2 6
Edison Swan 1st Pref.	1	7½	7½	30/–	—	5 0 0
Electric Construction	1	3½	7	37/6	—	3 14 8
Enfield Cable Ord.	1	25	25	5½xd.	+1/6	4 9 0
English Electric	1	Nil	Nil	27/–	+½	—
Do. Do. Pref.	1	Nil	Nil	28/–	+1/–	—
Ericsson Tel.	5/–	24	20*	2⅜	—	1 16 4
Ever Ready	5/–	35	35	25/6	–6d.	6 17 3
Ferranti Pref.	1	7	7	28/9	—	4 17 5
G.E.C. Pref.	1	6½	6½	35/–	—	3 14 4
Do. Ord.	1	10	15	85/–	+6d.	3 10 7
Henleys	1	30	30	7⅛	+⅛	3 18 2
Do. 4½% Pref.	5	4½	4½	5½xd.	+2/–	3 18 3
India-Rubber Preferred	1	—	5½	1½	—	4 17 9
Johnson & Phillips	1	7½	10	48/3	—	4 3 0
Lancashire Dynamo	1	5	10	2⅜	—	3 9 7
Siemens Ord.	1	4	6	31/3	+⅛	3 17 0
Telegraph Construction	£1	Nil	Nil	30/–	—	—

* Dividends are paid free of Income Tax.

Published Specifications

Compiled expressly for this journal by a firm of chartered patent agents. The numbers in parentheses are those under which the specifications will be numbered and abridged and all subsequent proceedings will be taken.

1934

31195. "Wireless transmission and reception." H. A. Richardson. November 30th, 1935. (450444.)
32403. "Push-pull detector for television purposes." Radio Akt.-Ges. D. S. Loewe. November 10th, 1933. (450241.)
35516. "Electric switch apparatus for the automatic control of temperature or fluid pressure." C. E. Jones. December 11th, 1934. (450446.)
35546. "Alternating-current circuit-breakers." Akt.-Ges. Brown, Boveri & Cie. December 11th, 1933 (450245.)
35590. "Automatic electric lighting unit for life-saving jackets." Winckler Engineering Laboratories, Inc. February 9th, 1934. (450355.)
35648. "Electrical-frenquency indicators, also speed indicators." T. A. Ledward and Record Electrical Co., Ltd. December 12th, 1934. (450400.)
35660. "Radio receivers." Radio Akt.-Ges. D. S. Loewe. December 13th, 1933. (450247.)
35685. "Means for effecting accurate correlation of the cap and the body part of an ignition interrupter and distributor." J. Lucas, Ltd., H. Dillow and W. F. Fenn. December 12th, 1934. (450312.)

1935

1089. "Electromagnetically actuated relays and mechanisms with particular reference to electric switch actuation." A. G. Bullen. January 12th, 1935. (450453.)
1384. "Means for observing the image produced by X-rays on a fluorescent screen." Soc. Anon des Manufactures des Glaces et Produits Chimiques de St. Gobain," Chauny & Cirey. January 16th, 1934. (450513.)
1452. "Electric circuit-breakers." A. Reyrolle & Co., Ltd., B. H. Leeson and R. W. Wild. January 16th, 1935. (450405.)
1532. "Television transmitting arrangements." Marconi's Wireless Telegraph Co., Ltd., and H. M. Dowsett. January 16th, 1935. (450413.)
1534. "Kerr cells." Marconi's Wireless Telegraph Co., Ltd., R. J. Kemp and J. J. Mason. January 16th, 1935. (450463.)
1647. "Devices for keeping telephones clean and sanitary." L. W. Young and G. D. Pidduck. January 17th, 1935. (450465.)
1654. "Acoustic-frenquency electrical circuit arrangements." H. J. Round. January 17th, 1935. (450468.)
1679. "Systems of control for electrically driven lifts." General Electric Co., Ltd., N. C. Smart and A. A. Chubb. January 18th, 1935. (450469.)
1834. "Protective devices for consumers' electrical apparatus." A. Sadler (Schiele & Bruchsaler Industriewerke Akt.-Ges.). January 19th, 1935. (450362.)
1842. "Automatic station selectors for radio receivers." W. J. Bowman. April 20th, 1934. (450472.)
2237. "Methods of controlling electric light circuits." British Thomson-Houston Co., Ltd., and A. L. Whiteley. January 23rd, 1935. (450518.)
2382. "Electrical temperature-control systems for heating units." L. A. Lindberg. January 24th, 1935. (45049.)
2455. "Cam-operated, multiple-contact electric switches." B. Hesketh. January 25th, 1935. (450320.)
2499. "Apparatus for use in spot-lighting." W. E. Rawson-Bottom and C. Pelling. January 25th, 1935. (450481.)
2510. "Electric-discharge lamps." British Thomson-Houston Co., Ltd., and W. J. Scott. January 25th, 1935. (450482.)
2575. "Tuning and feeder arrangements for use in radio receiving and like installations." Marconi's Wireless Telegraph Co., Ltd., and N. M. Rust. January 25th, 1935. (450520.)
2833. "Radio direction-finding." Telefunken Ges. für Drahtlose Telegraphie. January 27th, 1934. (450484.)
4060. "Inductance coil arrangements for use in radio receiving sets." E. K. Cole, Ltd., and H. Hunt. February 8th, 1935. (450262.)
6035. "Wireless receiving circuits and apparatus." G. V. Bowding. February 25th, 1935. (450263.)
7075. "Lamps suitable for motor vehicles and the like." P. G. Parrott. March 6th, 1935. (450421.)
8277. "High-frequency electrical oscillators and transmitters." Marconi's Wireless Telegraph Co., Ltd. March 20th, 1934. (450423.)
9298. "Prepayment meters for electricity, gas and the like commodities." N. Wright and Metropolitan-Vickers Electrical Co., Ltd. March 25th, 1935. (450339.)
10300. "Tuning-indicator drives associated with variable condensers of wireless receivers." F. E. Harmer and J. E. Bell. April 3rd, 1935. (450364.)
12065. "Electric water-heaters." English Electric Co., Ltd., and E. Barrie. April 18th, 1935. (450366.)
12684. "Apparatus for receiving electrical signals." General Electric Co., Ltd., N. R. Bligh and G. M. Wells. April 27th, 1935. (450272.)
14008. "Closing of gas-tight containers such as the envelopes of electric-discharge devices." M-O Valve Co., Ltd., and D. A. Bovland. May 13th, 1935. (450275.)
15887. "Systems for preventing radio interference by electrically driven apparatus." Electrolux, Ltd. June 2nd, 1934. (450278.)
16616. "Control systems for engine electric vehicles." D. M. Livsey. (Aktieselskabet Frichs.) December 10th, 1934. (Divided out of 35461/34.) (450344.)
21954. "High-frequency electric wave apparatus." Standard Telephones & Cables, Ltd. October 4th, 1934. (450280.)
23175. "Electric condensers." Ideal Werke Akt.-Ges. für Drahtlose Telephonie. August 27th, 1934. (450433.)
23254. "Electric incandescent lamps." Naamlooze Vennootschap Philips' Gloeilampenfabrieken. October 8th, 1934. (450371.)
25143. "Thermal cut-outs for limiting the temperature in electrically heated appliances." Voigt & Haeffner Akt.-Ges. March 23rd, 1935. (450282.)
26304. "Single anode ionic valves." Allmänna Svenska Elektriska Aktiebolaget. September 27th, 1934. (450374.)
26822. "Trunk communication electric cables with air space insulation." Siemens & Halske Akt.-Ges. September 27th, 1934. (Cognate applications 26823/35, 26824/35, 26825/35, and 26826/35.) (450375.)
28252. "Coils for use in high-frequency electrical apparatus." Steatit-Magnesia Akt.-Ges. October 12th, 1934. (Cognate application 28253/35.) (450286.)
28721. "Photo-electric relay systems." British Thomson-Houston Co., Ltd. October 17th, 1934. (450287.)
32552. "Mounting and interconnection of electric switches." British Brass Fittings, Ltd., and W. J. G. Sperryn. November 25th, 1935. (450381.)
33761. "Contacts for electric switches." Porzellanfabrik Kahla. December 6th, 1934. (450382.)
35135. "Control systems for multiple electric motor drives." British Thomson-Houston Co., Ltd. December 19th, 1934. (450295.)
35240. "Electric condensers." Bryce, Ltd. January 11th, 1935. (450385.)
35908. "High-frequency iron cores." E. Michaelis. December 28th, 1934. (450297.)
35977. "Electric thermal relays." British Thomson-Houston Co., Ltd. December 29th, 1934. (450298.)

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45. "Telephone instruments." D. S. Steuart and N. B. M. Douglas-Hamilton Duchess of Hamilton and Brandon. January 23rd, 1935. (Divided out of 448894.) (450510.)
9068. "Television or like transmitting installations." Telefunken Ges. für Drahtlose Telegraphie. March 26th, 1935. (450303.)
10276. "Electrode systems with unsymmetrical conductivity." Naamlooze Vennootschap Philips' Gloeilampenfabrieken. June 1st, 1935. (450393.)
11261. "Grid-current detector for television purposes." Radio Akt.-Ges. D. S. Loewe. November 10th, 1933. (Divided out of 450241.) (450351.)
14610. "Electric switch apparatus for the automatic control of temperature or fluid pressure." C. E. Jones. December 11th, 1934. (Divided out of 450446.) (450512.)

Trade Mark Applications

The following are among the recent applications for British trade marks. Objections against any of the proposed marks may be entered within one month from August 5th:—

Lanco. No. 568768. Class 6. Electric motors.—Frederick W. Langley, Slippery Street, Hanley, Staffs.

T.M.C. (lettering and design). No. 568051. Class 8. Electrical condensers.—The Telephone Manufacturing Co., Ltd., Hollingsworth Road, West Dulwich, S.E.21.

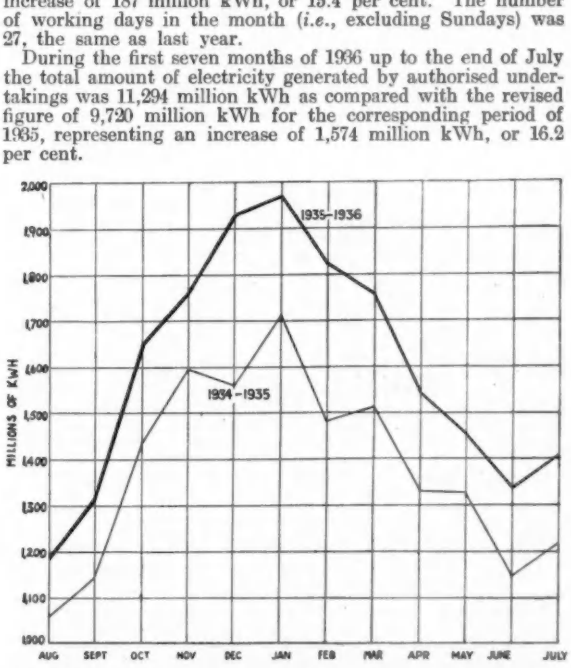
Tre Vita, Tremendous Vitality (lettering and design). No. 569017. Class 13. Electric lamps (ordinary).—Wartburg Lamps, Ltd., Imperial Works, Perren Street, N.W.5.

Intervolta. No. 567875. Class 50. Electrical insulating varnishes, and electric insulating substances of asbestos, mica, resin, oils or bitumen.—The International Paint and Compositions Co., Ltd., 31-32, Grosvenor Place, Westminster, S.W.1.

Generation of Electricity in July

THE official returns rendered to the Electricity Commissioners show that 1,403 million kWh of electricity was generated by authorised undertakings in Great Britain during July last, as compared with the revised figure of 1,216 million kWh in the corresponding month of 1935, representing an increase of 187 million kWh, or 15.4 per cent. The number of working days in the month (*i.e.*, excluding Sundays) was 27, the same as last year.

During the first seven months of 1936 up to the end of July the total amount of electricity generated by authorised undertakings was 11,294 million kWh as compared with the revised figure of 9,720 million kWh for the corresponding period of 1935, representing an increase of 1,574 million kWh, or 16.2 per cent.



The output of authorised undertakings in the twelve months to the end of July last, with comparative curve for 1934-35

New Work for Contractors

Particulars of new works and building schemes for the use of electrical installation contractors and traders

Publication in this list is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

Airdrie.—Houses (500); burgh surveyor.

Aldershot.—Extensions to Isolation hospital (£31,498); borough surveyor. School, Manor Park (1,000 places); director of education.

Alford (LINCOLNSHIRE).—Houses (24); F. Robinson, builder, Spilsby.

Angmering (SUSSEX).—Development of Ham Manor estate; Hesketh Estates, Ltd.

Ashton-in-Makerfield (LANCASHIRE).—Houses (82), Flora Street; U.D.C. surveyor.

Barrow-in-Furness.—Houses (90), Central Drive; Styles & Bates. Extensions to North Lonsdale Hospital, Church Street; governors.

Birkenhead.—Houses (60) and flats, Gautby Road; Cilcen Estates, Ltd. Houses (174), Hoylake Road estate (£73,000); E. B. J. Gould, Ltd.

Birmingham.—Factory, Amington Road, for Wilmott-Breeden, Ltd., Camden Street (£20,000), with electrical work; W. J. Whittall & Sons, builders, Lancaster Street. Municipal Bank and flat, 595, Kingstanding Road; Wm. J. Davey, architect, 8, Newhall Street.

Blackpool.—Large extensions to central premises, Coronation Street and Sheppard Street, for the Co-operative Society; S. Kerfoot & Son, builders, 62, Bryan Road. Houses, Knowle Avenue and Devonshire Road; R. Fielding & Son.

Bolton.—Houses (40), Barrow Bridge Road; F. R. Makin. Motor body works, Manchester Road; Miles Edwards. Technical college; Edwin S. Hoare, consulting engineer. Extensions to works, Back Broom Street; H. Peers & Co., Ltd.

Brigg.—Houses (700), Broughton; A. R. Haynes, architect, and surveyor, Wawby Street.

Bristol.—Municipal buildings (£400,000); E. Vincent Harris, architect.

Carshalton.—School, Green Wrythe Lane; R.C. authorities.

Chelmsford.—Swimming bath; Baths Committee.

Chertsey.—Houses (30); U.D.C. surveyor.

Cheshunt.—Senior schools, for the Church of England managers; Rev. A. E. Grain. Houses (40); U.D.C. surveyor.

Chester-le-Street.—Houses, South Pelaw and Pelton Fell, and Chester Moor; U.D.C. surveyor.

Chichester.—Cinema, Eastgate Square; Gaumont British Picture Corporation, Ltd.

Colchester.—Senior school (720 places), Sheepen Farm; J. Cuckney, secretary, Education Office, Trinity Street.

Coventry.—Houses (200), Pinley estate; city surveyor. Cinema, on the site of the old Scala Theatre, Far Gosford Street; T. J. Meakin & Sons. Factory, near Burnaby Road, for the Coventry Felt Co., Ltd., Wellington Street; Builders, Garlicks, Ltd., Far Gosford Street.

Crewe.—Houses (50) and extensions to Municipal offices; L. Reeves, borough surveyor.

Croft (YORKSHIRE).—Houses (22); W. Boyd, architect, Council Offices.

Cumberland.—School, Thursby; director of education, Carlisle.

Doncaster.—Houses (58), Wheatley Park estate; borough surveyor.

Dorset.—Grammar school, Bridport, for County E.C. county architect, Dorchester.

Easington.—Houses (29), Middle Street, Blackhall; Hays & Gray, architects, Central Chambers, Wingate.

Enfield.—Houses (139), Pembroke Avenue; W. Goodchild & Co. Extensions to works; Enfield Cable Works, Ltd.

Feltham.—Extensions to St. Anthony's Home for the Crusade of Rescue; E. B. Norris, architect, 22, Greengate, Stafford.

Flint.—Cinema, Bagillt, for Saronie's Enterprise; T. T. Rees and R. Holt, architects, 64, Rodney Street, Liverpool.

Flintshire.—Central schools, Rhyl, Holywell and Mold; County E.C.

Fraserburgh.—Factory for the Herring By-products, Ltd.

Gateshead-on-Tyne.—Clothing factory for Jackson The Tailors, Ltd., Clayton Street, Newcastle-on-Tyne.

Gillingham (KENT).—Houses (26), Cheriton Road, Rainham, for H. Sargent.

Glasgow.—Bridge over the Clyde, Finnieston (£1,200,000); city engineer. Buildings, Bridgeton, for W. & J. Martin, Baltic Street; the manager. Houses, Maryhill Road and Garscube estate; Housing director. Extensions to Zenith works, Thornliebank; Henry Wiggin & Co., Ltd. Cinema, Battlefield Road; Robert Pennycook.

Godstone (SURREY).—Houses (20), for Sir Bernard Greenwell.

Grantham.—Cinema, St. Peter's Hill, electrical work; J. Owen Bond & Son, architects, Norwich.

Hampshire.—Extensions to Park Prewett & Knowle Mental hospitals (£88,000), for C.C.; county architect, Winchester.

Hatfield (HERTFORDSHIRE).—Houses (182), Birchwood estate; H. C. Janes, Ltd., builders, St. Albans.

Hitchin.—Houses (22); R.D.C. surveyor.

Huddersfield.—Houses (800) and flats; borough surveyor.

Ipswich.—Development of Poplars estate, Henley Road and St. Edmunds Road; H. S. Kenney. Estate development, near Bramford Lane; H. Palmer. School, Stoke site (£18,622), and extensions to Mental hospital (£12,886); G. A. Kenney & Sons.

Irvine (AYRSHIRE).—Houses (156) (£50,000); burgh surveyor.

Isle of Ely.—County mental institution, March, for C.C.

Lanark.—Houses (146); burgh surveyor.

Leicester.—Rebuilding the central premises, High Street, for the Leicester Co-operative Society; Building Dept., Ash Street.

Llanelly.—Houses (39), Bryncaredig Dafen; R.D.C. architect.

London.—(SHADWELL).—Extensions to factory for Meredith & Drew, Ltd., 158, High Street, E.10. (WANDSWORTH).—Rebuilding library (£16,650); borough engineer.

Mildenhall (SUFFOLK).—Houses and public offices; R.D.C. surveyor.

Motherwell.—Houses (650), Wishaw; burgh surveyor.

Musselburgh.—Houses (92), Goose Green; J. Logan, burgh surveyor, Municipal Buildings.

Neath.—Maternity and child welfare centre, Glynneath; J. T. Jones, R.D.C. engineer and surveyor, 13, Orchard Street.

Northallerton.—Houses (21); R.D.C. surveyor.

Nottingham.—Laundry (£100,000) for the Midland Co-operative Laundries' Association.

Oldham.—Library, Stoneleigh Park; borough engineer.

Oxford.—Houses (45), Marston Road, No. 2 site; James Bros., builders, Oxford.

Penmaenmawr.—Houses (50); U.D.C. surveyor.

Peterborough.—Cinema, The Broadway, for J. Bancroft.

Reading.—Houses (160); housing architect.

Rochester.—Houses (200), Strood, for Taylor, Woodrow Estates, Ltd.

Ross-on-Wye.—Town Hall on a site overlooking the River Wye; F. Evan Davoll, architect, Gloucester Road.

Rotherham.—Central school, Clough Bank, for E.C. Extensions to works, Greasborough Road; W. N. Baines & Co., Ltd.

St. Albans.—Houses (21), Hedley Road, for A. H. Witney. Extensions to factory, New Barnes Avenue, for Electrical Apparatus Co., Ltd.

Salvington (SUSSEX).—Houses (138), High Salvington, for High Salvington Estates, Ltd.; H. H. Pannett.

Scarborough.—Houses and flats, Greylands estate (£44,830); borough engineer.

Sheffield.—Houses (27), Allenby Drive; Wright & Walton. Houses (34), Far View Road; H. Simpson. Houses (248), Parson's Cross estate; city architect. Houses (142), near Seagrave Road; E. Cooper. Civic centre; Prof. Abercrombie. Two cinemas, Bradfield Road and Holme Lane; J. F. Emery. Estate development of Dore Lane; Chatsworth Estates Co. Residential school, Ash House estate, Dore, for E.C.

Smethwick.—Additions to factory, J. A. Phillips & Co., Ltd., Bridge Street (£20,000) with electrical work; Whittalls & Son, Ltd., builders, Lancaster Street, Birmingham.

Southall.—Houses (214), Dane Road estate; U.D.C. surveyor.

Southampton.—Factory for Kelvin, Bottomley & Baird, Ltd., Glasgow.

Southport.—Pier and promenade improvement (£46,000), &c.; A. E. Jackson, borough engineer.

Spenborough.—Houses (400); U.D.C. surveyor, Cleckheaton.

Staffordshire.—Rebuilding, St. John's Hospital, Newcastle, for P.A.C.; county architect, Stafford.

Stalybridge.—Shops, Demesne Street and Hawke Street; Lowe & Ratcliffe.

Stockport.—Extensions to Craven Bros. (Manchester), Ltd.

Stone (STAFFORDSHIRE).—Council chamber and offices; U.D.C. surveyor.

Stourbridge.—Additional buildings at the rear of Eagle House for H. P. Jones (Eagle House), Ltd., High Street; T. W. Edwards & Sons, builders, Audnam.

Stroud (GLOUCESTERSHIRE).—Houses (51); R.D.C. surveyor.

Studley (WARWICKSHIRE).—Cinema, for H. S. Scott.

Sunderland.—Factory, for Dunn, Ltd.; W. & T. R. Milburn architect, 17, Fawcett Street.

Surrey.—Central laundry (£170,000), for C.C.; clerk, Kingston-on-Thames. Extensions to Mental hospital, Brookwood; county architect.

Taunton.—Houses (198), Halcon estate; Ivor F. Shellard, borough engineer.

Wallsend-on-Tyne.—Houses, east end and west end of the borough; borough engineer. Isolation hospital for the County Nursing Association; C. F. Murphy, Newgate Street, Morpeth.

Walsall.—Public abattoir near Birchills generating station (£80,000) with electrical work; J. Taylor, surveyor, Town Hall.

Waltham Cross.—Cinema and shops, High Street; Howis & Belcham, architects, 77, Chancery Lane, London, W.C.2.

Warrington.—Houses (60), Longshaw Street; H. Greenwood. Welfare centre, Folly Lane; Bewsey Adult School trustees. Extensions to Borough hospital (£114,607); J. Dolan & Sons, Ltd.

Warwickshire.—Additions and new laundry, Heathcote Isolation Hospital, with electrical work; Henry Lea & Son, consulting engineers, 158, Edmund Street, Birmingham.

West Bromwich.—Municipal and administrative buildings, Highfields estate (£100,000), with electrical work; D. Ellison, borough surveyor.

Weymouth.—Houses (140); borough engineer.

Whitehaven.—Houses (236), Greenbank; borough surveyor.

Widnes.—Houses (500); borough surveyor.

Willenhall (STAFFORDSHIRE).—Houses (286); U.D.C. surveyor.

Wishaw.—Houses, Campbell Street (£103,000) and Glasgow Road district (£165,000); L. Costley, burgh surveyor, Town Hall, Motherwell.

Woking.—Houses (21); U.D.C. surveyor. Cinema, Chobham Road and Church Street; Union Cinemas, Ltd.

Wolverhampton.—Houses (156), Green Lane, Aldersey; Brian Construction Co. Estate development, Bhylls Lane; Annan & Jones. Development of St. Catherine's estate, Penn; A. N. Bloxham.

Woodford (ESSEX).—Extensions to Bancroft's school, Woodford Wells (£40,000), for the Drapers' Co., Drapers' Hall, London, E.C.2; F. R. D. O. Monro, chairman of the Governors.

York.—School, Osbaldwick Lane, for City E.C.; Charles J. Minter, city engineer.